CENTRAL VALLEY
FLOOD MANAGEMENT
PLANNING PROGRAM

FloodSAFE
CALIFORNIA

Management Actions Report

Appendix A:
Management Actions Descriptions

November 2010

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

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Reader's Guide to the Management Action Descriptions

A management action is a specific structural or nonstructural strategy, action, or tactic that contributes to the Central Valley Flood Protection Plan (CVFPP) goals and addresses identified flood management problems in the Systemwide Planning Area, including any identified deficiencies in the State Plan of Flood Control.[1] Management actions may range from potential policy or institutional changes, to recommendations for operational and physical changes to the flood management system. Management actions may address one or more CVFPP goals and are the "building blocks" for regional solutions and eventually systemwide solutions.

A two to three-page description/evaluation form was prepared for each management action. The process of developing these forms occurred through an iterative process wherein California Department of Water Resources (DWR) subject-matter experts, CVFPP work group members, staff from the U.S. Army Corps of Engineers (USACE) and other partner agencies, and members of the public identified and compared characteristics of different actions during workshops, and meetings, and independently. Each management action was examined against a range of criteria and judged with specific economic, environmental, technical, and social considerations in mind. The following is a description of each section of the description/evaluation form.

- **Management Action Title –** Includes the name of the management action.
- **Identification (ID) –**The management actions each have an ID number, shown as MA-XXX, which carry no particular significance or ranking other than to provide an action its own unique identifier. Although this report includes 94 management actions they appear as MA-001 to MA-103; significantly revised or deleted management actions still retain their original ID numbers to avoid confusion, even though they do not appear in the final list of 94.
- **Description**
  - **Problem –** Describes the problem or class of problems that the management action is designed to address.
  - **Desired Outcome –** Describes the desired and/or anticipated outcome of implementing the management action.

[1] Refer to the CVFPP Interim Progress Summary No. 1. California Department of Water Resources, May 2010.

  - **Methodology –** Describes the specific steps involved in executing the management action. May include a range of implementation methods.

- **CVFPP Goals –** Indicates the draft 2012 CVFPP Goal to which the management action most significantly contributes. Because each management action has the potential to contribute to more than one goal, all applicable goals are identified.

- **Recommendations –** Identifies whether or not the management action is retained for further evaluation in the CVFPP planning process, and identifies specific features of the management action that may require further evaluation.

- **Advantages and Disadvantages –** Summarizes the key advantages and disadvantages of the management action, determined from the qualitative analyses of economic, environmental, social, and technical considerations.

- **Economic Considerations**

  - **Capital Cost –** Management actions will have a range of requirements for initial capital, from policy changes with low capital costs to large infrastructure projects with substantially higher capital costs. This section describes the anticipated capital costs associated with the implementation of the management action.

  - **Annual Cost to Operate/Maintain/Repair –** Ongoing operations, maintenance, and repairs to the existing flood management system represent a substantial portion of flood management costs. These costs also include often expensive permitting and mitigation. The management action is evaluated qualitatively, based on its potential to increase or decrease the annual costs to operate, maintain, and/or repair the flood system.

  - **Potential for Cost-Sharing –** Multiple local, State, and federal agencies share responsibility for flood management in the Central Valley. Many management actions provide potential for the State to share costs with these other agencies. This section identifies potential cost-sharing partners and opportunities associated with each management action.

  - **Emergency Response and Recovery Costs –** Flood emergency operations costs include mobilization of emergency response personnel and resources, evacuation costs, as well as the monitoring and notification activities that trigger mobilization when a flood may occur. Post-flood recovery includes programs and actions that restore public infrastructure and services, provide aid to individuals, and facilitate other forms of assistance to individuals, businesses, and communities. In this section, the management action is qualitatively evaluated on its potential to increase or decrease costs for emergency response and recovery programs.

- **Flood Fighting Cost** – Although California Emergency Management Agency (CalEMA) is the State's lead on overall emergency response, DWR is the lead State agency for flood-fight assistance and flood emergency response. Section 128(a) of the California Water Code authorizes DWR in times of storms or floods to take any remedial measures necessary to avert, alleviate, repair, or restore damage or destruction to property having a general public or State interest. In this section, the management action is qualitatively evaluated on its potential to increase or decrease costs for flood fighting.

- **Effect on Damage to Critical Infrastructure –** Management actions have the potential to impact critical public infrastructure such as roads and utility corridors. In many cases this will be region specific, and evaluation is not possible on a Valley-wide scale. Where possible, the management action is evaluated for its potential to have an effect on damage to critical public infrastructure.

- **Effect on Floodplain and Economic Development –** In the Central Valley, population growth is driving demand for new development. Much of the new development is occurring in areas that are susceptible to flooding. In this section, the management action is evaluated on its potential to alter projected trends in economic development in floodplains.

- **Effect on State Flood Responsibility** – The flood management system in the Central Valley includes 1,600 miles of levees that protect more than half a million people, 2 million acres of cultivated land, and approximately 200,000 structures with an estimated value of $47 billion. In this section, the management action is evaluated on its potential to increase or decrease State flood responsibility.

- **Environmental Considerations**

  - **Potential to Rehabilitate Key Physical Processes and Ecological Functions –** The construction of dams, levees, bank revetments, engineered channels, and related flood management facilities has altered natural flow regimes, resulting in changes to the natural hydrologic, geomorphic, and biologic processes in the Sacramento and San Joaquin river basins. In this section, the management action is qualitatively evaluated on its ability to rehabilitate these processes and functions.

  - **Potential for Adverse Environmental Impacts –** Flood management actions, especially structural management actions, have the potential to adversely impact the environment while meeting other flood management goals. Each management action is evaluated on its potential to create adverse environmental impacts such as habitat loss and alteration of key physical processes.

- **Permitting Considerations –** The process for obtaining permits and mitigating the potential impacts of flood management actions can be costly and complex, involving extensive coordination with multiple agencies. In this section, the management action is evaluated on the relative expense and complexity of required permitting.

- **Opportunity to Reduce Adverse Environmental Impacts Associated with Operation, Ongoing Maintenance, and Repairs of Flood Management System –** Flood maintenance activities can sometimes conflict with the attainment of ecosystem goals. Levee and floodway maintenance and repair practices and policies, and operation of the flood management system often reduce or eliminate habitat complexity within the river corridors on which many native aquatic and terrestrial species are dependent. In this section, the management action is evaluated based on its potential to reduce the environmental impacts associated with operations, ongoing maintenance, and repairs of the flood management system.

- **Social Considerations**

  - **Contribution to Public Safety –** Protection of public safety is a key component of the FloodSAFE California (FloodSAFE) Vision. Each management action is evaluated to determine its impacts on public safety, based on the extent to which the action has the potential to reduce the frequency of flooding (i.e., increase the level of protection), and reduce damages when floods occurs.

  - **Potential to Provide Other Benefits –** Management actions have the potential to provide other benefits not specifically listed in the CVFPP Goals. Examples of other benefits include water supply, recreation, and open space. A qualitative description of each management action’s potential to provide these supplementary benefits is provided.

  - **Likelihood of Implementation –** Certain management actions may meet multiple CVFPP Goals, but implementation may be unrealistic for political, economical, institutional, and/or cultural reasons. The management action is evaluated based on the likelihood of its implementation. Specific political, institutional, and/ or cultural constraints with the potential to restrict implementation are identified.

- **Technical Considerations**

  - **Potential for Redirected Hydraulic Impacts –** Redirected flood impacts occur when a project moves the risk of flooding from one area to another area. For example, improvements to flood protection in one area can result in increased flood flows in a downstream area; therefore, increasing the flood risk downstream. Each management action is qualitatively evaluated with respect to its potential to redirect hydraulic impacts.

- **Effect on Residual Risk –** Residual risk is the portion of risk that remains after flood control structures have been built. Risk remains because of the likelihood of the measures' design being surpassed by the flood's intensity and of structural failure of the measures.[2] Residual risk can be mitigated by management actions that reduce life loss and property damages when flooding occurs. In this section, the management action is evaluated on its potential impact on residual risk after implementation.

- **Climate Change Adaptability –** The potential consequences of climate change can have significant effects on the State.[3] Sea-level rise and changes in precipitation patterns and extreme events due to climate change will alter Central Valley hydrology and bring new flood management challenges. In this section, the management action is evaluated with respect to its potential to increase the adaptability of the flood management system to the impacts of altered climatic regimes.

[2] Risk Management and Critical Infrastructure Protection: Assessing, Integrating, and Managing Threats, Vulnerabilities and Consequences. Moteff, John. Washington DC: Congressional Research Service, 2005.
[3] 2009 California Climate Adaptation Strategy. California Natural Resources Agency. December 2009.

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1.0 Additional Floodplain and Reservoir Storage

MA-001: Enlarge existing transitory floodplain storage

MA-002: Construct new transitory floodplain storage

MA-003: Increase on-stream flood storage capacity by building new storage facilities

MA-004: Update/modify/replace existing flood storage facilities

MA-006: Increase flood control allocation by expanding existing, on-stream reservoirs

MA-007: Increase foothill and upper watershed storage

MA-008: Increase flood control allocation by using spillway surcharge

MA-009: Increase flood control allocation by expanding existing, or building new, off-stream storage

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Enlarge existing transitory floodplain storage

ID MA-001

Description

Problem

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired to manage downstream flooding, or there is flooding that occurs on unregulated streams. Transitory floodplain storage areas can help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels, in addition to, or instead of increasing downstream channel capacity.

Desired Outcome

Increased available transitory flood management storage downstream from the flood management reservoirs to reduce or attenuate flood peaks.

Methodology

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas. Once flow in the river decreases, water in the transitory storage area may flow or be pumped back into the river channel. Transitory storage measures could be attained by natural means, such as flows at certain stages overtopping a bank and flowing into adjacent lands, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. This may necessitate acquisition of flowage or other easements. Transitory storage measures may involve flood attenuation both locally and downstream from the storage area. Enlargement of existing transitory storage areas may involve new or modified outfall structures and weirs, or modifications to berms or training dikes to increase available storage area. Other existing structures may also be suitable for use as transitory storage, such as irrigation canals usually dry during the winter months. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for restoration in riparian areas, or in wetland, shallow water, or terrestrial habitats.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify existing transitory storage areas with potential for enlargement or reoperation.

Advantages

- Works well in conjunction with other management actions that increase system capacity and/or strengthen levees
- Can promote multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge, where applicable)
- Increased storage provides greater flexibility to adapt to changing climate conditions
- Moderate cost

Disadvantages

- Few existing transitory storage sites may be suitable or socially acceptable for expansion
- Cost of land acquisitions to increase existing storage may be high and there may be impacts to local tax base if land is acquired in fee title
- May be difficult to acquire entire transitory storage area from willing sellers
- Potential aquatic or terrestrial environmental impacts in expanded storage area if not currently active floodplain
- Potential impacts to existing land uses within or adjacent to expanded transitory storage area
- Some areas may require construction of facilities to return flood flows back to the waterways.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-low initial investment, depending on location and extent of required modifications to enlarge existing transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of any structural modifications).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for small increase in operations and maintenance costs in existing transitory storage areas.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration), with requirement for local sponsor to provide lands, easements, rights-of-way, relocations, and dredged or excavated materials disposal areas.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential decrease in long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease in the need for flood fighting due to reduction in peak flows and the frequency or magnitude of flooding.

Effect on Damage to Critical Infrastructure?

Location-specific, but may reduce damage to downstream infrastructure in rivers and tributary areas. However, damage in existing transitory storage floodplain may increase.

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of downstream flood protection, which may encourage development in floodplain areas receiving these benefits. Potential to change existing land use within any new storage area.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease in State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could help rehabilitate physical processes and ecological functions if transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing and Sacramento splittail spawning habitat).

Potential for Adverse Environmental Impacts?

If transitory floodplain storage is expanded into areas that are not active or are historical floodplains or flood basins, it could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially to seasonal wetland habitats (including potential loss of habitat for special-status species). Adverse impacts could also potentially occur from contaminants in flood waters, sediment transport, or cause potential fisheries issues.

Permitting Considerations?

Expansion of existing transitory storage areas would require new or modified permits.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Lower flows downstream would result in a decrease in required operations and maintenance and attendant environmental impacts. Lands used for transitory storage may also be used for mitigation of other CVFPP projects.

Social Considerations

Contribution to Public Safety?

Likely increase. Reduces frequency of flooding and improves level of flood protection; no residual risk, as would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats. Potential to contribute to groundwater recharge. Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Higher likelihood of implementation, generally, than constructing other types of new on- or off-stream storage, but some institutional, funding, and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts such as sediment deposition and/or erosion resulting from diversion of flow from river, both in the river and within transitory storage inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development. However, may increase residual risk for areas adjacent to transitory storage areas.

Climate Change Adaptability

Increased transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enhance biological adaptability if transitory storage is located in historical floodplains or flood basins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions).

Construct new transitory floodplain storage

ID MA-002

Description

Problem

Currently, there is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows to the extent needed/desired to manage downstream flooding, or there is flooding that occurs on unregulated streams. Transitory floodplain storage areas can help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels, in addition to, or instead of increasing downstream channel capacity.

Desired Outcome

Increased available transitory flood management storage downstream from the flood management reservoirs to reduce or attenuate flood peaks.

Methodology

Transitory storage occurs when peak flows in a river are diverted to adjacent off-stream storage areas. Once flow in the river decreases, water in the transitory storage area may flow or be pumped back into the river channel. Transitory storage measures could be attained by natural means, such as flows at certain stages overtopping a bank and flowing into adjacent lands, or could be engineered using weirs and bypasses to direct flows onto adjacent lands. Transitory storage measures may involve flood attenuation both locally and downstream from the storage area. There may be opportunities to establish new transitory storage in existing floodplains or areas that experience frequent flooding. Wildlife refuges and certain types of rural or agricultural lands may be suitable for use as transitory storage. This may necessitate acquisition of flowage or other easements. Transitory storage areas may also be built into multi-stage setback levees or widened levee corridors. Transitory storage could also provide opportunities to restore ecosystem functions or habitats. For example, allowing overland flows could promote natural erosion and deposition processes and provide opportunities for restoration in riparian areas, or in wetland, shallow water, or terrestrial habitats. New transitory storage would likely include control facilities such as weirs to control the stage in the river at which the storage begins to operate, and also control the flow rate into the storage area. Existing infrastructure in a new transitory storage area would need to be protected.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions

- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify locations where it is feasible to develop new transitory storage.

Advantages

- Works well in conjunction with other management actions that increase system capacity and/or strengthen levees
- Promotes multiple benefits in addition to flood flow reduction (ecosystem functions, habitat, groundwater recharge, where applicable)
- Increased storage provides greater flexibility to adapt to changing climate conditions
- Moderate cost compared to new reservoir construction.

Disadvantages

- New transitory storage sites may be scarce/limited due to social acceptability and cost
- Cost of new land may be high and there may be impacts to local tax base if land is acquired in fee title
- May be difficult to acquire entire transitory storage area from willing sellers
- Potential aquatic or terrestrial environmental impacts in new storage area if not currently active floodplain
- Potential impacts to existing land uses within or adjacent to new transitory storage area

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-low initial investment, depending on location and extent of construction required to develop new transitory storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of new facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased operations and maintenance costs would be associated with any new transitory storage facility; cost would likely be low compared with other actions providing similar benefits.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management, water supply, and/or environmental restoration).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential decrease in long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding. However, emergency response and recovery costs in the transitory storage area may increase and could be substantial.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease in the need for flood fighting due to reduction in peak flows and the frequency flooding.

Effect on Damage to Critical Infrastructure?

Location-specific, but may reduce damage to downstream infrastructure in rivers and tributary areas.

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of downstream flood protection, which may encourage development in floodplain areas receiving these benefits. Potential to change existing land use within any new storage area.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease in State flood responsibility by reducing the frequency of downstream flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could help rehabilitate physical processes and ecological functions if new transitory storage is located in historical floodplains or flood basins (enhancing floodplain forming processes, increasing salmonid rearing ,Sacramento splittail spawning habitat, and other special status species).

Potential for Adverse Environmental Impacts?

If new transitory floodplain storage is created in areas that are not active or historical floodplains or flood basins, could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats (including potential loss of habitat for special-status species). Adverse impacts could also potentially occur from contaminants in flood waters.

Permitting Considerations?

Potentially extensive or complex permitting, depending on location.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Lower flows downstream would result in decrease in required operations and maintenance and attendant environmental impacts. May also be used for mitigation of other CVFPP projects.

Social Considerations

Contribution to Public Safety?

Likely increase. Reduces frequency of flooding and improves level of flood protection; no residual risk (as would be associated with similar benefits provided by levees or other downstream features).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to restoration of floodplain functions and habitats. Potential to contribute to groundwater recharge. Possibility for creating new recreational or open space areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new transitory storage would generally have a higher likelihood of implementation than constructing other types of new on- or off-stream storage, but some institutional, funding, and political challenges exist (land use changes, operations and maintenance responsibilities, others).

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No redirected downstream impacts; potential local hydraulic impacts such as sediment deposition and/or erosion resulting from diversion of flow from river, both in the river and within transitory storage inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

New transitory floodplain storage would enhance hydrologic adaptability by increasing water management flexibility; could enhance biological adaptability if transitory storage is located in historical floodplains or flood basins (increasing the ability of aquatic and floodplain species to adjust to changing climate conditions).

Increase on-stream flood storage capacity by building new storage facilities

ID MA-003

Description

Problem

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The addition of new on-stream flood management storage capacity in appropriate watersheds could reduce downstream flood releases, in addition to or instead of increasing downstream channel capacity.

Desired Outcome

Increased available flood management storage capacity through the construction and use of a new on-stream reservoir.

Methodology

A new flood management reservoir could be constructed on a stream in a watershed that already contains a flood management reservoir; it could be constructed upstream or downstream from an existing flood management reservoir; or it could be constructed in a watershed that has no existing flood management reservoirs. Constructing a new flood management reservoir in any of these locations would provide additional flood management storage to allow better management of flood flows to decrease the probability of releasing damaging flows downstream. The new reservoir could also be designed to provide multipurpose benefits, as applicable.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate on-stream sites where developing a new flood management reservoir is feasible.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees
- May promote multiple benefits in addition to flood peak reduction (water supply, hydropower, cold water pool for fisheries management, recreation)

- Increased storage provides greater flexibility to adapt to changing climate conditions

Disadvantages

- High capital cost
- Likely impacts to terrestrial and other environmental resources in reservoir inundation area
- Potential to impact downstream fisheries and floodplain habitat by reducing peak flows or blocking access to spawning areas
- Potential to block migratory patterns
- Large political and institutional challenges

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of new on-stream storage (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. Operations and maintenance would be needed at new dam facilities.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential decrease in long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease in the need for flood fighting due to reduction in peak flows and the frequency flooding.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to infrastructure in downstream rivers and tributary areas.

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of downstream flood protection, which may encourage development in floodplain areas receiving these benefits. Potential to change existing land use within any new storage area.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of downstream flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Negative impact likely in new reservoir area and possible downstream locations; some limited benefits in tailwater fisheries (fisheries at the outflow of large dams).

Potential for Adverse Environmental Impacts?

Substantial permanent impacts to aquatic and riparian habitat including loss of habitat in reservoir area and loss of habitat connectivity (e.g., fish migration) for special-status species and other native anadromous species; substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that would result in permanent impacts to habitat for aquatic and riparian species. May inundate tribal lands in reservoir area. Reservoirs may also encourage the introduction of invasive species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Much lower likelihood of implementation than expanding existing on- or off-stream storage. Institutional and political challenges would be large.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential redirected downstream impacts due to diminished peak flows that will affect channel morphology; potential increase in downstream erosion as a result of sediment removal by dam; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development. However, residual risk exists of dam failure or flow in excess of objective release.

Climate Change Adaptability

Enhances hydrologic adaptability by increasing water management flexibility; and, it could reduce biological adaptability by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

Update/modify/replace existing flood storage facilities

ID MA-004

Description

Problem

Certain existing dams may have been built to different standards and sizes or for different purposes than those required today, or they may be aging to the point that operations and maintenance and safety considerations suggest retrofit or replacement. Replacement of an existing dam can provide increased safety, flood management and/or water supply storage, and operational flexibility for flood operations. Retrofit of an existing dam can provide operational flexibility or additional flood management storage through operational changes.

Desired Outcome

Storage facilities that provide systemwide operational flexibility and increase public safety, flood management, and/or water supply storage.

Methodology

The Central Valley has a long history of replacing existing dams. Replacing a dam could be done by constructing a new dam either upstream or downstream from the existing dam, and then decommissioning or removing the old dam when the new one is completed. The new dam is often significantly larger than the existing dam, thus providing additional flood management storage to improve the operations and reduce flood flows. Retrofitting a dam could include a new spillway, such as the one at Folsom Dam that allows the release of larger inflows before it is necessary to start storing water before flood operations, or could include raising the top of the dam to increase storage capacity in the reservoir.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate reservoirs where additional storage could be provided by replacing an existing dam, or where operational flexibility could be enhanced by modifying or retrofitting an existing dam.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees

- Promotes multiple benefits in addition to flood flow reduction (water supply, hydropower, cold water pool for fisheries management)
- Increased storage provides greater flexibility to adapt to changing climate conditions

Disadvantages

- Potentially high capital cost.
- Potential terrestrial environmental impacts in reservoir inundation area.
- Potential to impact downstream fisheries and floodplain habitat by reducing peak flows.

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of replacement dam (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of replacing existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce operations and maintenance costs by replacing or retrofitting aging dams and appurtenances.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of downstream flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No significant direct effects; however, reduces the frequency of flooding and increases level of downstream flood protection, which may encourage development in floodplain areas receiving these benefits. Potential to change existing land use within any new storage area.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of downstream flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Substantial temporary impacts to aquatic and riparian habitat would result from dam replacement. Increasing the storage (inundating additional area in the reservoir) would result in substantial permanent impacts to upland and potentially seasonal and/or freshwater marsh wetland habitat including loss of habitat for special-status species; and would result in moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Replacing an existing dam would generally have a higher likelihood of implementation than constructing new on-stream storage, but significant institutional, funding, and political challenges still exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential redirected downstream impacts due to diminished peak flows that will affect channel morphology; potential increase in downstream erosion as a result of sediment removal by dam; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

An increase to the water storage would enhance hydrologic adaptability by increasing water management flexibility.

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Increase flood control allocation by expanding existing, on-stream reservoirs

ID MA-006

Description

Problem

There is insufficient flood management storage available in some existing flood management reservoirs to adequately regulate flood flows. For example, if there is insufficient flood control allocation in a reservoir, the first part of a storm can fill the available storage because downstream releases are limited by downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of the storm.

Desired Outcome

Increased available flood management storage allocation to improve the ability to regulate flood flows.

Methodology

Expansion of existing on-stream reservoirs may be easier and more effective to accomplish than building a new reservoir because of the lack of feasible sites for new on-stream reservoirs. Raising an existing dam and thereby enlarging the existing flood management reservoir could provide additional flood management storage allocation while at the same time maintaining or increasing conservation storage. Increasing flood management storage allocation in an existing reservoir usually comes at the expense of conservation storage, except when the existing dam is raised to increase the total storage behind the dam. The additional storage in the reservoir can be divided between conservation storage and flood management storage, as needed, but the entire storage of the reservoir will be available for water supply storage after the flood season.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate reservoirs where additional storage is needed and feasible.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees.

- Promotes multiple benefits in addition to flood flow reduction (water supply, hydropower, cold water pool for fisheries management)
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages

- Potentially high capital cost.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential recreational impacts.
- Potential dam safety concerns when raising a dam.

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and extent of expansion (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Larger reservoirs or dams cost more to maintain.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

More operational flexibility with increased storage, including wider range of possible downstream flow regimes.

Potential for Adverse Environmental Impacts?

Expanding existing on-stream reservoirs would result in permanent impacts to aquatic and riparian habitat in the reservoir inundation area, including loss of habitat and habitat connectivity (e.g., fish migration) for special-status species. This action also would result in moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species. Expansion may also encourage the introduction of invasive species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in storage; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Raising an existing dam would generally have a higher likelihood of implementation than constructing new on-stream storage, but significant environmental, institutional, and political challenges still exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential redirected downstream impacts due to diminished peak flows that will affect channel morphology; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

Enhances hydrologic adaptability by increasing water management flexibility, could reduce biological adaptability if new storage area interrupts wildlife migration corridors.

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Increase foothill and upper watershed storage

ID MA-007

Problem

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The flood management allocation space requirements drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve. The availability of additional flood storage in upper watershed reservoirs can reduce the required flood storage in the foothill flood management reservoirs.

Desired Outcome

Increased available storage in upper watershed reservoirs, upstream from flood management reservoirs, to improve regulation of flood flows.

Methodology

When storage is available in reservoirs upstream from a flood management reservoir during flood season, that storage can often be counted as available flood storage (e.g., French Meadows and Hellhole for Folsom Dam and Mammoth Pool for Friant Dam). While upstream reservoirs cannot be operated for flood management, incidentally available storage in existing upper watershed reservoirs could be increased by allowing surcharging of the spillways, to increase the storage in the reservoir before spills. The use of surcharging is dependent on the design of the dam and spillway, but may be applied if it does not reduce the safety of the dam. Since most of the upper watershed dams do not have operational gates on their spillways, the surcharge could be achieved through the use of temporary or permanent flashboards on top of the spillway of the upstream reservoir.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees.
- Promotes multiple benefits in addition to flood flow reduction (water supply, hydropower, cold water pool for fisheries management).

- Increased incidental flood storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages

- Dam safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.
- Similar storage volumes in upstream reservoirs are less effective because they affect a smaller portion of the watershed than the downstream reservoir, and because upstream reservoirs are not configured for flood operations and it is not possible to control the rate of filling of the flood pool.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-low initial investment, depending on location and extent of spillway modifications (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential increase to operations and maintenance costs from placing and removing surcharges.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Increasing foothill and upper watershed storage would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in upstream storage; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, and fisheries management.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional and political challenges still exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Few redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

Increasing use of available upstream storage would enhance hydrologic adaptability by increasing water management flexibility, but could reduce biological adaptability downstream by reducing the complexity of habitats.

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Increase flood control allocation by using spillway surcharge

ID MA-008

Description

Problem

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. Some of the reservoirs on the Sacramento and San Joaquin rivers have insufficient storage capacity to fully capture average annual unimpaired runoff if no releases are made. From a flood management perspective, maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season. The deep empty space requirements often drive mandated releases during the flood season to maintain flood storage within the operational flood encroachment curve. In the San Joaquin Valley, the first part of a flood can fill some reservoirs, and flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events.

Desired Outcome

Increased storage in foothill flood management reservoirs.

Methodology

It may be possible to increase the available storage in existing flood management reservoirs by allowing surcharging of the spillways, to increase the storage in the reservoir before spills. The use of surcharging is dependent on the design of the dam and spillway, but if it does not reduce the safety of the dam, it could be achieved through modified operations of gated spillways and the use of temporary or permanent flashboards on top of ungated, auxiliary spillways.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate flood management reservoirs where it is feasible to add additional storage by allowing surcharging on spillways.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees.

- Promotes multiple benefits in addition to flood flow reduction (water supply, cold water pool for fisheries management) by adding flood management allocation without lowering bottom of flood pool.
- Increased storage provides greater flexibility to adapt to changing climate conditions.
- Low cost.

Disadvantages

- Dams safety considerations.
- Potential aquatic and terrestrial environmental impacts in reservoir inundation area.
- Potential impact to shoreline recreation facilities in surcharged reservoirs.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-low initial investment, depending on location and extent of spillway modifications (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity of structural modifications to existing dam facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential increase to operations and maintenance costs from placing and removing surcharges..

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Increasing storage in foothill flood management reservoir would result in moderate to substantial temporary or permanent impacts (dependent on actions) to terrestrial, wetland, and riparian, including potential loss of habitat for special-status species. Other potential impacts include: change in flow regime (e.g., seasonality, magnitude, and duration of flows), sediment transport, and habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in storage; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional storage in an existing dam through spillway surcharging would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional, funding, and political challenges still exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

Increasing flood storage allocation would enhance hydrologic adaptability by increasing water management flexibility.

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Increase flood control allocation by expanding existing, or building, new off-stream storage

ID MA-009

Description

Problem

There is insufficient flood management storage available in some existing flood management reservoirs to regulate flood flows. The first part of a flood can fill some reservoirs, because flood operations are limited by the downstream channel capacities. This increases the likelihood of spilling large flood flows during the latter part of storm events.

Desired Outcome

Increased available flood management storage allocation in existing reservoirs without impacts to water supply allocations.

Methodology

Construct a new off-stream storage reservoir and necessary conveyance facilities. Each reservoir would likely need to be built in relatively close proximity to an existing reservoir so that water could be transferred easily from the flood management reservoir to the off-stream reservoir. Before and during flood season, the availability of storage in the off-stream reservoir could allow water to be diverted from the conservation pool in the flood management reservoir to the off-stream storage reservoir. This would increase the flood management storage in the flood management reservoir while at the same time saving the water diverted from the conservation pool into the off-stream reservoir to be used to replace or augment regular water supply releases later in the year. Storage in the off-stream reservoir would not be creditable or usable as flood management storage, and diversions to the off-stream reservoir would likely have to occur before the beginning of any flood events so that the additional flood storage would be available in the flood management reservoir during flood operations. Delta islands could be used for off-stream storage. This would not require new conveyance, as the water from the flood management reservoir could be sent down the river for storage in the Delta islands before the beginning of flood season. This method would only work if the water being released from conservation storage is allocated for use either in the Delta, or for export.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify candidate off-stream sites where developing new storage and associated conveyance is feasible.

Advantages

- Will work well in conjunction with other management actions that increase downstream system capacity and/or strengthen levees.
- May promote multiple benefits both as standalone reservoir or in conjunction with existing reservoirs in addition to flood flow reduction (water supply, cold water pool for fisheries management, recreation) if storage is maintained after flood season is over.
- Increased storage provides greater flexibility to adapt to changing climate conditions.

Disadvantages

- Potentially high capital cost
- Terrestrial environmental impacts in reservoir inundation area
- Offstream storage potentially less effective than on-stream storage for flood management.

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment, depending on location and size of off-stream reservoir (cost factors include real estate acquisitions, relocations, mitigations cost, and complexity and size of required dam and conveyance facilities).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Operations and maintenance costs from new dam facilities must be considered, as well as potential pumping costs to convey the water to the off-stream site.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Potential for private sector cost-sharing for water supply benefits.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

Direct effects would include a boost to the economy during construction of the new reservoir. Indirectly reduces the frequency of flooding and increases level of flood protection, which may encourage new development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Substantial permanent impacts to terrestrial and potentially wetland habitat, including potential loss of habitat for special-status species; moderate to substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species in the off-stream reservoir site. If the on-stream reservoir doesn't fill due to drawdown, will have impacts on cold water pool, which will impact downstream fisheries.

Permitting Considerations?

Extensive and complex permitting required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection commensurate with increase in storage; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply, hydropower, recreation, and fisheries management if storage is maintained after flood season. Potential to reduce recreational benefits in on-stream reservoir due to lowered pool during flood season. Potential to impact recreation in off-stream reservoir site.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Developing new off-stream storage would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional, funding, and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No redirected downstream impacts; potential hydraulic impacts within reservoir inundation area.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

This action would enhance hydrologic adaptability by increasing water management flexibility; and it could reduce biological adaptability by reducing the quantity and connectivity of habitat, which would reduce the ability of species to handle and adjust to the consequences of climate change.

2.0 Storage Operations

MA-011: Establish partnerships to coordinate flood management structure operations

MA-012: Increase flood management flexibility through modifications to the magnitude/timing of flood reservations in reservoirs

MA-013: Increase flood management flexibility through modifications to objective release schedules at flood management reservoirs

MA-014: Increase flood management flexibility by implementing conjunctive use programs at flood management reservoirs

MA-067: Implement advanced weather forecast-based operations to increase reservoir management flexibility

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Establish partnerships to coordinate flood management structure operations

ID MA-011

Description

Problem

Flood management facility operations are not always coordinated between regions or agencies and do not necessarily serve multiple uses. The lower San Joaquin River region is an example in which systemwide coordinated operations are needed to prevent downstream flooding from prescribed releases. Lower San Joaquin River levee and diversion systems are not capable of containing the objective release (maximum control release that can be safely conveyed by downstream channels) from all major, upstream project reservoirs simultaneously due to reductions in channel capacity from sedimentation, debris, and vegetation. Current flood operations may also adversely impact ecosystem function and habitat requirements. Climate change, water supply, conjunctive use, and transitory storage, which often have conflicting needs, are also not considered during current operations.

Desired Outcome

Enhanced ability to coordinate and modify operation of existing structures to better manage floods while serving multiple uses of the system. Reduce the frequency, magnitude, and impacts of downstream flooding.

Methodology

Use new and existing partnerships to coordinate flood management structure operations. For example, DWR's Reservoir Coordinated Operations Section and the Hydrology Branch of the Hydrology and Flood Operations Office have embarked on a Forecast Coordinated Operations initiative, in partnership with the USACE, National Weather Service (NWS), and individual reservoir operators, to develop the means for interagency coordination of reservoir releases. This will ensure all flood relief structures are operated and maintained as designed to preserve systemwide operational integrity. Operations of all facilities should be coordinated to reduce downstream impacts and serve multiple uses within the system. In some instances, coordinated operations could benefit from modifications to existing reservoir control manuals. System models could be used to verify results of proposed operations in real time to assist in coordination of operations to achieve these goals.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained; coordination of reservoir operations will be studied by DWR in upcoming study.

Advantages

- Will work well in conjunction with other management actions that increase upstream system capacity and/or strengthen levees
- Low cost to implement.
- High value to water supply management.
- High value to ecosystem support if floodplains are used in reoperation scenarios.

Disadvantages

- May result in water supply, environmental, and recreation impacts.
- Interagency coordination on multiple levels can be difficult and time consuming.
- Coordinated operations can involve transfer of risk if reservoirs are operated in a coordinated manner. Such operations may increase risk in one area, while decreasing risk in another.

Economic Considerations

Capital Cost? (High, Medium, Low)

Relatively low expected initial investment for development of coordinated operations, which are non-structural in nature. Physical costs could include communications, computer equipment, and model development.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for decreased channel O&M if high flows in channels are reduced as a result of coordinated operations. Balancing storage may produce potential water supply cost savings as additional flood management is achieved without increasing flood management allocation in multi-purpose reservoirs.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Potential also for local agency or reservoir operator to cost share.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of downstream flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease the frequency (and long-term cost) of downstream flooding.

Effect on Damage to Critical Infrastructure?

May reduce flooding, therefore reducing damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Potential to reduce the damaging floods and increase level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing the frequency of flooding. Will not reduce frequency of floods in floodplains or bypasses but could reduce likely damaging floods by better flood water management between reservoirs and floodplains/bypasses/detention basins.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

The potential is limited because the goal of reservoir coordinated operations is to guide reservoir releases in advance of and during major flood event to reduce peak flood flows, resulting in additional levels of protection downstream. While system reoperations can be a key component to developing multi-benefit scenarios between flood management and water supply protection and environmental benefits through re-managed floodplains in strategic locations, that would require reoperation of reservoirs outside of flood operations, which is not in the scope of the CVFPP.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

FERC relicensing considerations for certain facilities, potentially significant CEQA/NEPA requirements, additional flood easements may require new permitting or authorization.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

New opportunities will be provided to reduce O&M with coordinated management.

Social Considerations

Contribution to Public Safety?

Reduces frequency of flooding and improves level of flood protection; some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features. Also would increase water supply security and public resources protection and enhancement.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to contribute to water supply by reducing need for additional flood management storage. Would create or maintain environmentally functioning open-space or agriculturally beneficial open space if floodplains are used in reoperation scenarios.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Institutional and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

This management action attempts to manage cumulative downstream impacts from flood management facilities and also has hydraulic impacts to environmental land or river systems and the Delta.

Effect on Residual Risk?

The objective of coordinated operations would be to reduce the frequency and magnitude of downstream flooding, reducing residual risk to existing development. Will have some residual risk from possibility of flood operations causing increase in downstream flows.

Climate Change Adaptability

This management action could enhance hydrologic adaptability by incorporating climate change scenarios in operations and by increasing flexibility of water management.

Increase flood management flexibility through modifications to the magnitude/timing of flood reservations in reservoirs

ID MA-012

Description

Problem

Reservoir operations conducted by many federal, State, and local agencies are largely governed by water control manuals specific to each reservoir. These water control manuals guide operational decisions on the timing and amount of flood space throughout the year and establish objective releases. Operational constraints imposed by manuals can make systemwide, multipurpose coordinated operations and goals difficult to accomplish.

Desired Outcome

Improved use of existing flood management and conservation storage for flood management and reduced downstream flood peaks.

Methodology

Work cooperatively with local entities to explore how changes to the flood reserve space can improve flood management flexibility. One example of this is the Sacramento Area Flood Control Agency's use of upstream storage and its agreement to purchase water if the use of additional flood storage space in Folsom Reservoir results in lost water supply.

Modifications to reservoir rule curves could be made to specify additional downstream control points and require the coordination with operations of other reservoirs. System models should not only be used to verify results but model application should be further extended to develop new rules of operation. System models could be used to verify results of proposed operations in real time to assist in coordination. Operations could be enhanced through the use of advanced weather forecasts.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages

- Will work well in conjunction with other management actions that increase upstream system capacity and/or strengthen levees.
- Low cost to implement
- Potential value to water supply management.

Disadvantages

- Modification of reservoir operations may affect water supply yield, hydropower generation (which is a function of storage in the reservoir), environmental flows and temperature, and recreation.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial investment compared to structural alternatives such as construction of additional storage, but will include costs for process of authorizing additional space (which may require additional legislation) and likely significant environmental documentation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation. Changing the magnitude of flood storage could result in significant impacts to other authorized project benefits and shifts in cost allocations among beneficiaries.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease long-term costs for emergency response and recovery through reduction in the frequency and magnitude of downstream flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease the frequency (and long-term cost) of downstream flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

Potential to reduce the frequency of flooding and increase level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Reservoir reoperations could be beneficial to restoring fluvial geomorphic processes needed by certain species, and thereby also enhance the ecological functions of aquatic and floodplain habitats.

Potential for Adverse Environmental Impacts?

Increasing flood control space may reduce high frequency flows that are important for restoring ecosystems.

Permitting Considerations?

Approving modified system rule curves is a major undertaking with USACE and may require legislation to change allocation of storage and reservoir operation.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would reduce residual risk. This management action would have some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Possible positive or negative impact to reservoir recreation benefits depending on higher or lower carryover storage following end of flood season. Potential to reduce water supply yield, but may provide drinking water quality benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult and may require congressional approval, but may not be required in all instances. This management action would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, institutional, funding, and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Reoperation would likely have redirected downstream impacts, but they would include reduction in peak stage during flood operations.

Effect on Residual Risk?

The objective of reoperation would be to reduce magnitude of downstream flood peaks and therefore the frequency of failures leading to flooding, reducing residual risk to existing development. Operating reservoirs as a system may transfer risk from one watershed to another during flood operations.

Climate Change Adaptability

Modification of operations at flood control reservoirs could enhance hydrologic adaptability by increasing flexibility of water management, particularly if climate change scenarios are incorporated in operations. This management action could also enhance biological adaptability by increasing the extent and quality of some aquatic and floodplain habitats, and thus, increase the ability of species to handle and adjust to the consequences of climate change.

Increase flood management flexibility through modifications to objective release schedules at flood management reservoirs

ID MA-013

Description

Problem

Reservoir operations are largely governed by water control manuals specific to each reservoir. These water control manuals guide the timing and amount of flood space throughout the year and establish objective releases (maximum controlled release that can be safely conveyed by downstream channels). Many downstream levee and diversion systems, such as the lower San Joaquin River, are not capable of containing the combined objective releases of upstream reservoirs.

Desired Outcome

Improved use of existing flood management and conservation storage to better manage flood flows and protect downstream lands and facilities.

Methodology

Objective release schedules should be reviewed and revised, if needed, based on recent data and current watershed conditions. Modifications to increase objective releases could provide more flexibility and safety systemwide and decrease the rate and quantity of required reservoir flood allocation for the same level of protection. Decreasing the objective release would have the opposite effect, reducing downstream effects on facilities but also requiring a larger flood management reservation. Releases could be modified to increase the prescribed releases for a given level of forecasted inflow and percent of flood management space used.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify reservoirs where reoperation may be feasible.

Advantages

- Will work well in conjunction with other management actions that increase upstream system capacity and/or strengthen levees
- Low cost to implement
- Potential value to water supply management.

Disadvantages

- Modification of reservoir operations may affect water supply yield, hydropower generation (which is a function of storage in the reservoir), environmental flows and temperature, and recreation.
- Increasing objective release may result in increased downstream erosion.
- Potential for moderate alteration of downstream geomorphic processes, including flow regime, resulting in impacts to habitat for aquatic and riparian species.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial investment compared to structural alternatives such as construction of additional storage, but will include costs for process of authorizing a change in objective release (which may require additional legislation) and likely significant environmental documentation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs from reservoir reoperation. Lower objective releases would likely result in lower maintenance costs to repair damage from frequent floods.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease long-term costs for emergency response and recovery through reduction in the frequency or magnitude of downstream flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease the frequency (and long-term cost) of downstream flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of downstream flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing the frequency of downstream flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Reservoir reoperations could be beneficial to restoring fluvial geomorphic processes needed by certain species, and thereby also enhance the ecological functions of aquatic and floodplain habitats.

Potential for Adverse Environmental Impacts?

Potential for moderate alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species. Coordination with resource agencies could help minimize adverse impacts.

Permitting Considerations?

Approving modified objective release is a major undertaking with USACE and may require legislative approval.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Modifying objective releases for flood management may provide flexibility for dealing with fishery needs.

Social Considerations

Contribution to Public Safety?

Any reoperation that reduces frequency of flooding and improves level of flood protection would have some residual risk of dam failure, but less than would be associated with similar benefits provided by levees or other downstream features.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to protect water supply by reducing need for additional flood management storage. Potential reservoir recreation benefits if higher carryover storage after flood season is over.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Modifying reservoir control manuals for flood management reservoirs would be difficult, but would generally have a higher likelihood of implementation than constructing new on- or off-stream storage. However, substantial institutional, funding, and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Reducing objective releases would have redirected downstream impacts, but they would likely include reduction in peak stage during flood operations.

Effect on Residual Risk?

The objective of modification of objective releases would be to reduce the magnitude of downstream flood peaks and the frequency failures leading to flooding, reducing residual risk to existing development.

Climate Change Adaptability

Modifying objective release schedules at flood control reservoirs could enhance hydrologic adaptability by increasing water management flexibility.

Increase flood management flexibility by implementing conjunctive use programs at flood management reservoirs

ID MA-014

Description

Problem

Reservoirs and transitory floodplain storage areas help regulate flood flows by attenuating or reducing the magnitude of flood peaks occurring in downstream channels. Currently, there is insufficient flood management storage available in existing flood management reservoirs to regulate flood flows to the extent needed/desired. Maintaining sufficient flood reservation space within reservoirs becomes critical during the rainy season, and maintaining that space results in mandated releases from storage during the flood season. Conjunctive use projects may be able to use a portion of these mandated releases for groundwater recharge, where feasible. Current climate modeling suggests California will experience higher peak flows during floods and greater need for water supplies, with possibly more severe droughts. As runoff patterns shift under climate change, the ability to capture water after the flood season will diminish. Managing the combination of water supply and flood risk may require new methods to satisfy all the needs.

Desired Outcome

Expanded management tools and methods available for both flood and water supply to increase flood management flexibility.

Methodology

Adding additional flood management storage allocation in an existing multi-benefit reservoir frequently results in a conflict with water supply storage allocation because if no changes are made to the reservoir, any increase in flood storage allocation results in a decrease in conservation storage. This conflict may be alleviated by pre-storing the water supply allocation in a groundwater bank through conjunctive use operations. Pre-storing will likely be required because groundwater banks aren't able to take water in sufficient quantity to be used during flood operations and they are often already taking water during floods and might not be able to accept additional inflow. With the water stored in a groundwater bank, some of the shortfalls that might result from the increase in flood management storage allocation could be replaced with water withdrawn from the groundwater bank.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify reservoirs where conjunctive use operations may be feasible.

Advantages

- Potential to provide additional flood management allocation without constructing new storage.
- Potential to provide other benefits such as water supply.
- Potential to protect against salinity intrusion in some groundwater basins.

Disadvantages

- Potential to lose water permanently after recharge, which would not be recoverable for water supplies.
- Land may not be readily available for recharge.
- Acquiring recharge land in fee may remove from tax base.
- Difficult to know capacity of undeveloped groundwater recharge location.
- Surface storage has recreation and cold water pool benefits; redirecting storage to groundwater will diminish these benefits.
- Coordination between agencies and implementing land use changes would be challenging.
- Potential contamination of native ground water from injected surface flows.
- Groundwater recharge could lead to high groundwater tables.

Economic Considerations

Capital Cost? (High, Medium, Low)

Moderate initial investment, depending on location and extent of facilities required to conduct conjunctive use operations (cost factors include real estate acquisition, conveyance and pumping facilities, and environmental documentation and mitigation costs). Costs would be distributed across multiple sources but primarily come from water supply and flood management funds.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs would likely increase significantly resulting from O&M for new conjunctive use facilities, especially the pumping costs associated with accessing water supplies stored in groundwater banks.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management and/or water supply). Because multiple benefits are incorporated, costs may be distributed across multiple programs and fund sources.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease long-term costs for emergency response and recovery through reduction in the frequency or magnitude of downstream flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease the frequency and peak flow (and long-term cost) of downstream flooding.

Effect on Damage to Critical Infrastructure?

Region specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of downstream flooding and increases level of flood protection, which may encourage development in the floodplain. Some recharge areas may be sited on floodplains, so that these areas would be restricted in their development potential. The increase in water supply reliability should improve economic development, but there are potential negative impacts if groundwater doesn't satisfy the same need as the surface water, or if excessive water supply is lost in the groundwater bank.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Groundwater recharge facilities provide seasonal habitat to migratory waterfowl.

Potential for Adverse Environmental Impacts?

If new artificial recharge facilities are constructed in floodplains or agricultural lands, this action could result in moderate to substantial permanent impacts to terrestrial, agricultural, and potentially seasonal wetland habitats, including potential loss of habitat for special-status species. Changing a land use of any type has impacts. If reservoir doesn't completely fill after flood operations, the smaller cold water pool may affect anadromous fisheries. Increasing flood control space may reduce high frequency flows that are important for restoring ecosystems. Coordination with resource agencies would be needed.

Permitting Considerations?

Extensive and complex permitting required, including water rights permits for water diverted from reservoir conservation pool to groundwater recharge.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Tempering peak flows has potential to reduce required O&M therefore reducing adverse environmental impacts. If recharge areas are not developed, may be used as mitigation for other CVFPP projects.

Social Considerations

Contribution to Public Safety?

May reduce frequency of flooding and improve level of flood protection.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide water supply benefits, given the ability to store excess flood waters, and then access them during dry periods.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Providing additional flood storage allocation through conjunctive use would generally have a higher likelihood of implementation than constructing new on-stream storage, but institutional, funding, and political challenges exist.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential for redirected downstream hydraulic impacts if river used to convey water from reservoir to groundwater recharge site. Likely hydraulic impacts at recharge site.

Effect on Residual Risk?

The objective of conjunctive use to increase flood storage allocation would be to reduce the frequency of downstream flooding, reducing residual risk to existing development.

Climate Change Adaptability

This action would enhance hydrologic adaptability by increasing reservoir water management flexibility. Implementation needs to consider impacts on biological adaptability.

Implement advanced weather forecast-based operations to increase reservoir management flexibility

ID MA-067

Description

Problem

During the flood season, reservoir operators currently follow the Water Control Manual and corresponding Flood Control Diagram developed by USACE for their operation of each reservoir. Most of the flood control diagrams are based on conditions currently occurring in the reservoir and often do not provide the operational flexibility needed to improve flood protection and water supply. Flood control diagrams also do not take advantage of the most recent advancements in weather and river forecasting and data gathering and exchange to minimize the downstream impacts of reservoir releases.

Desired Outcome

Increased flexibility of operations at flood control reservoirs in the Central Valley achieved using advanced forecasting information based on snow accumulations in the basin, basin wetness, runoff forecasts, quantitative precipitation forecasts, and climate change information.

Methodology

Implementation would require (1) developing weather forecasting and hydrologic models, and (2) coordinating with reservoir operators, and may require updating existing forecasting technologies. Forecast-based operations would provide operators with information on potential future reservoir inflows and would allow them to better save the flood management storage for the peak of the storm to help minimize the risk of exceeding river channel capacity. Knowledge of potential future flows and reservoir releases would increase the warning times to communities along the rivers and downstream from flood control reservoirs.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low capital cost.
- Decreases costs for many activities, including flood fighting, emergency response and recovery, and some O&M activities.

Disadvantages

- Requires more testing, as advanced weather forecast-based operations have not been used extensively in real-time operations.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low-to-medium, depending on whether forecasting technology (such as radars that provide better weather forecasts) needed to be updated. Primary capital costs consist of developing weather forecasting and hydrologic models, and establishing coordination with reservoir operators.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs if implementation includes updating the stream gage network or other forecasting technologies. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs would increase due to flood forecasting efforts and the necessity for increased coordination with operators.

Potential for Cost-Sharing?

Yes. Significant potential for local and federal government cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential decrease. Forecast-based operations would facilitate consistent and timely response during flooding, which would reduce potential damage and need for recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential decrease. Forecasting would allow flood fighting efforts to be coordinated in advance of flood events, and could decrease long-term flood fighting costs.

Effect on Damage to Critical Infrastructure?

No direct effects; however, decreasing peak flows by operating reservoirs in advance of flood events could reduce damage to critical infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No direct effects; however, could potentially decrease State responsibility by reducing the frequency and consequences of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?
The increased flexibility could be used to the benefit of instream resources and hydrologic processes.Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by decreasing peak flows.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

While forecast-based operations would be targeted to improve flood management, it could also provide more flexibility in managing reservoirs to achieve other benefits (water supply, recreation, ecosystem needs, etc.).

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Forecast-based operations have thus proven to be politically and institutionally acceptable in some instances. For example, forecast-coordinated operations have been developed on the Yuba-Feather River system and are being developed on some San Joaquin river reservoirs. However, forecast-based operations may face some political and institutional resistance because they could create binding rules that would restrict the flexibility of individual reservoir operators.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk by reducing the frequency and consequences of flooding.

Climate Change Adaptability

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

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3.0 Flood Protection System Modification

MA-016: Improve conveyance by addressing flow constrictions

MA-017: Increase capacity of existing bypasses

MA-018: Modify existing weirs, overflows, or relief structures to improve flood system performance

MA-019: Construct new bypasses to improve flood system performance

MA-020: Construct new levees to provide flood protection to additional areas potentially affected by flooding

MA-021: Raise levees to improve flood system performance

MA-022: Construct setback levees

MA-023: Construct ring levees

MA-024: Improve structural performance and resilience of existing levees

MA-087: Construct closure structures

MA-088: Remove and/or deauthorize disconnected, redundant, and nonfunctional facilities of the SPFC

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Improve conveyance by addressing flow constrictions

ID MA-016

Description

Problem

Flow constrictions such as bridges, marinas, in-channel structures, and other obstructions can trap large debris during flood events causing flood waters to backup. The backwater caused by the constrictions can increase pressure on the levees and increase sediment accumulation upstream from the constriction while incising the channel bed and/or eroding channel banks downstream. In addition, flow constrictions could impact a channel's ability to accommodate reservoir objective releases.

Desired Outcome

Increased channel or bypass flood conveyance capacity and efficiency by reducing impedance to flood flow.

Methodology

Removal, modification, or relocation of flow constrictions and hard points can increase overall channel capacity and/or reduce flooding upstream. This could also improve operational flexibility of reservoirs. Specific actions or treatments would depend on the type of flow constriction or hard point. For example, existing bridges that impede flood flows could be removed, replaced, or modified/raised to improve conveyance; new bridges within designated floodways could be constructed to standards that prohibit constraints on conveyance capacity and reduce backwater effects. Dredging and sediment removal could be used to reduce other types of flow constrictions. Marinas or other flow impediments could be modified or relocated to prevent accumulation of debris during floods. Changing the physical features of the conveyance system to reduce flow constrictions could also provide opportunities to restore ecosystem functions or habitats. For example, removing rock revetment, dikes, or other structures in the channel in conjunction with setback levee construction could promote natural erosion and deposition processes and provide opportunities for riparian habitat restoration; wetland, shallow water, or terrestrial habitats could also be established in conjunction with projects to reduce flow constrictions and improve flood flow capacity.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to identify flow constrictions and specific actions.

Advantages

- Improve channel flow efficiency, thereby reducing flood risk.
- Works well in conjunction with other actions that increase system capacity and/or reliability.
- Potential to combine with other actions to improve ecosystem functions, habitat.
- Potential to reduce O&M costs associated with debris removal or erosion repairs.
- Beneficial to environment and wildlife (creates seasonal habitat).
- Increase in shaded riverine/riparian habitat using setback levees.

Disadvantages

- Potentially high capital cost.
- For bridge modifications, potential for traffic disruption.
- Channel modification (such as dredging), potential for water quality or other aquatic impacts.
- Permitting and mitigation may be costly, extensive and lengthy.
- Increased conveyance space for vegetation could offset increase in flood capacity.
- May cause potential downstream impacts.
- Removing marinas would be a disadvantage to boaters.

Economic Considerations

Capital Cost? (High, Medium, Low)

Potentially high initial investment depending on number and type of flow constrictions to be removed, replaced, or modified; bridge modifications or replacements could be costly. Permitting and mitigation costs could also be high. Potentially high cost for levee realignment.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

May reduce O&M costs associated with debris removal and erosion repairs after floods. However, O&M costs may increase if sediment removal is completed on a regular basis. O&M costs may increase to protect embankments and repair other damage to structures that can be eroded as a result of changes in the flow regime. Need to establish a long-term economic mechanism to maintain the system as a whole. Need to have maintenance funds in perpetuity.

Potential for Cost-Sharing?

Potential for federal cost-sharing via contributions to existing federal project purposes (flood management). Potential also exists for systemwide cost-sharing between locals, depending on the range of effects from the management action. For example, funds to replace functional or structurally deficient bridges can come from highway bridge replacement and rehabilitation program

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding due to increased channel conveyance capacity

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the long-term cost of flood fighting through reduction in the frequency or magnitude of flooding and reduction in debris removal actions during floods.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding due to increased channel capacity. Potential improvement to infrastructure

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State responsibility through reduction in the frequency or magnitude of flooding due to increased channel capacity.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Reducing flow constrictions and hard points could also contribute to rehabilitating physical processes, including sediment transport and channel forming processes, and could improve aquatic and riparian habitat (particularly if incorporated into design and implementation).

Potential for Adverse Environmental Impacts?

Reducing flow constrictions and removing geomorphic hard points would result in minor to moderate temporary impacts during construction (and potentially permanent impacts) to aquatic and riparian habitats and associated species, particularly if habitat is not incorporated into design and implementation. Permanent impacts may be possible if this management action results in increased development.

Permitting Considerations?

Extensive permitting requirements for most types of flow constrictions.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

By reducing constrictions, there is the potential to reduce the need for O&M, and therefore reduce the negative environmental impacts associated with O&M operations (assuming these improvements are designed to not increase erosion). O&M could be done at regular intervals, and could possibly be scheduled for times when the environmental impacts are minimal

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding due to increased channel capacity; no residual risk

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased water supply and water supply reliability; new seasonal habitat for native and migratory wildlife; safer conditions for recreationists; possible potential for navigation.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Dependent on site/location and type of flow constriction; for bridges, likelihood of implementation would depend on type (vehicle versus rail), capacity, design, and other factors. For marinas, in-channel structures, sedimentation, and geomorphic hard points other implementation factors may include ownership, ability to relocate, and other jurisdictional issues.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Restoring channel capacity can potentially increase downstream flood flows and stages and potentially affect sediment deposition and/or erosion; Increased habitat in the system slows down the flows, increasing the amount of sediment that is deposited and thereby reducing capacity, resulting in increased maintenance costs to restore capacity and increase impacts to habitat for capacity restoration. These impacts would need to be mitigated if downstream channel capacities could not accommodate increased flows. By reducing restrictions downstream, there is the potential to reduce levels upstream.

Effect on Residual Risk?

No change in residual risk.

Climate Change Adaptability

No direct effects.

Increase capacity of existing bypasses

ID MA-017

Description

Problem

Due to changes in the channel morphology, some bypasses cannot convey flood flows at their designed flow rates and corresponding design stage. This lack of conveyance results in higher flood stages in the channel and increase the stresses on the levees; thereby increasing the risks of flooding. In addition, changes in the land uses have altered the drainage patterns and thus flow though the flood management system that may necessitate reevaluation of the bypasses' design parameters. Existing overflow areas aren't engineered bypasses, just existing farmland.

Desired Outcome

Increased or restored the flood conveyance capacity of existing bypasses.

Methodology

This management action could include widening or expanding the footprint of existing bypasses to increase capacity. It could also include raising levees or berms along existing bypasses to create more flood carrying capacity. It may also require the reconstruction and/or reoperation of existing flow control weirs that direct flood flows into bypasses. This management action could also include sediment removal or vegetation control. Increasing the capacity of certain bypasses could provide opportunities for habitat, recreation, and agricultural enhancement; these functions would be integrated into the evaluation of specific actions.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to determine how existing bypasses could be modified to increase flood flow capacity.

Advantages

- Increases channel capacity and reduces flood risk (overtopping, levee breaks, etc.).
- Potential to combine with other management actions to restore habitat.

- May support recovery of threatened or endangered species.
- Lowers flood stage.

Disadvantages

- Moderate to high capital cost to widen bypasses, raise bypass levees, or reconstruct/modify weirs;
- Permitting and associated mitigation as well as additional vegetation maintenance could be costly and time consuming;
- Would restrict land use within the bypass.
- May complicate sediment routing processes.

Economic Considerations

Capital Cost? (High, Medium, Low)

Potentially high initial investment depending on number and type of flow constrictions to be removed, replaced, or modified; bridge modifications or replacements could be costly. Permitting and mitigation costs could also be high. Potentially high cost for levee realignment.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to increase O&M costs for vegetation control and management. Potential to decrease O&M costs if modifications are constructed to new design standards; less maintenance may be required

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the long-term cost of flood fighting through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity.

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State liability through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

In combination with other actions, increasing the capacity of existing bypasses could enhance Key Physical Processes and Ecological Functions by restoring more natural flow regime to bypasses within historic overflow areas (potential to restore channel and floodplain forming processes and improve salmonid rearing).

Potential for Adverse Environmental Impacts?

Increasing the capacity of existing bypasses by widening could result in substantial permanent impacts including loss of upland habitat and effects on associated species (including threatened and endangered species).

Permitting Considerations?

Extensive, complex, and potentially costly.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding due to increased flood conveyance capacity; no change in residual risk.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreation benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Bypass modification likely to be more feasible/implementable than construction of new bypasses

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Increasing bypass capacity can potentially increase downstream flood flows and stages; increasing conveyance may require reoperation of existing flood control facilities to minimize downstream impacts. Changing bypass pulse can change sedimentation transport throughout entire system.

Effect on Residual Risk?

None.

Climate Change Adaptability

Increasing the capacity of existing bypasses could enhance hydrologic adaptability by increasing water management flexibility; could potentially enhance biological adaptability by increasing the quantity of aquatic and riparian habitats and thus the ability of associated species to adjust to changing climate conditions.

Modify existing weirs, overflows, or relief structures to improve flood system performance

ID MA-018

Description

Problem

The outdated design of current flood relief structures, while providing flood protection, was not designed for flexibility. The design also creates areas of debris and sediment accumulation. The performance and operation of weirs and flood overflows can be negatively affected by factors such as accumulation of sediment or debris, downstream flow restrictions, antiquated control systems, subsidence, erosion, structural deficiencies, and functional obsolescence. Their design parameters (how the flows are regulated), may be functionally obsolete due to changes in the flood flows caused by differing land use, climate, and weather patterns. Their performances are also negatively affected by factors such as accumulation of sediment or debris, downstream flow restrictions, subsidence, erosion, and structural deficiencies as result of wear and tear. Also, some facilities act like flood relief structures but were never constructed to DWR or USACE standards to function like flood relief structures. The result is that head cuts to these facilities allow over flows, reducing the storage capacity of the facility.

Desired Outcome

Improved flood system operations and performance to meet current and future flood management needs.

Methodology

Aspects of the flood management system are controlled or operated via weirs (both with and without gates) and overflows (such as lowered segments of levees designed to permit overflows at certain stages) to divert flood flows to the bypasses and for irrigation during non-flood season. Weirs could be modified in several ways (raised, lowered, lengthened, or automated; changing the weir sill elevation) depending upon the operation and desired effect. For example, a weir crest could be raised to prevent flows from entering a storage area too early in a flood event, thereby reserving storage space for the storm peak. Alternately, weirs could be lengthened to pass more flow into a bypass at the same stage, or lowered to divert flow at lower stages. Other modifications could include removal of sediment or debris to improve the intended performance of the weir. Weir modifications could also be designed to provide opportunities to restore ecosystem functions or habitats, reduce operations and maintenance, and improve safety. For example, improvements to weirs could allow greater fish passage, change the flow split, manage sediment deposition, or increase the safety of weir operations (floodgates).

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Potential to allow for more active management of the flows through the flood management system.
- Potential to increase safety of flood management operations.

Disadvantages

- Moderate to high capital cost to raise, lower, lengthen, change operations for, or automate some weirs.
- Structures may have to be redesigned to incorporate Endangered Species Act (ESA) consideration that may require significant modifications to the existing facilities.
- May complicate sediment routing processes.

Economic Considerations

Capital Cost? (High, Medium, Low)

Moderate to high capital cost to raise, lower, lengthen, or automate weirs depending on the type, operation, and desired effect; In the upper watershed there will be a need to acquire more property to accommodate overflow.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to reduce O&M costs if weir operations are automated or modified to reduce sediment/debris removal requirements.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the long-term cost of flood fighting through reduction in the frequency or magnitude of flooding.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding.

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State responsibility through reduction in the frequency or magnitude of flooding if weir modifications increase channel capacity.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Weirs could be modified to facilitate operations that enhance Key Physical Processes and Ecological Functions (restoring more natural flow regimes, for example); depending on implementation, operational changes could benefit channel and floodplain forming processes and salmonid rearing

Potential for Adverse Environmental Impacts?

Depending on implementation, the modification of weirs could moderately alter physical processes downstream, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts (either beneficial or detrimental) to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

"Nuisance Flooding" increases the amount of debris that is deposited on agricultural properties as well as habitat/restoration areas. If this debris is not removed it tends to block and divert flows to other areas increasing erosion in some areas and sediment deposits in others. However, instream woody debris is heavily used by aquatic species, including Anadromous fish. Eliminating these nuisance flows will reduce damages to agriculture and habitat.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Reoperation of some weirs may provide some benefits with little cost; easements in bypasses may cause some issues.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Weir modification and reoperation could increase flows to the bypasses; these impacts would need to be mitigated if downstream channel capacities could not accommodate increased flows.

Effect on Residual Risk?

None.

Climate Change Adaptability

Modifying weirs could enhance hydrologic adaptability by increasing water management flexibility.

Construct new bypasses to improve flood system performance

ID MA-019

Description

Problem

Some reaches of the flood management system have insufficient flow capacity due to lack of transitory storage and ability to attenuate the flood flows. In addition, limited funding for structural improvements (need to increase the level of protection in response to changes in the land-use, weather, and climatic patterns) may require a reevaluation on how the flood waters are routed through the flood management system.

Desired Outcome

Provide relief to the areas of the flood conveyance system that do not have the capacity to provide the required level of flood protection.

Methodology

New bypasses could be constructed to redirect damaging flood flows away from the existing channels and facilities that currently lack sufficient conveyance. Siting for new bypass construction needs to take into consideration various items such as the topography, the magnitude of the redirected flow, and potential downstream hydraulic impacts; opportunities for habitat, recreation, and agricultural enhancement; and right-of-way requirements.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Increases channel and system capacity and reduces flood risk.
- Potential to integrate ecosystem restoration/habitat.
- Potential to provide or maintain other benefits (recreation, groundwater recharge).
- Moderate the peaks in the flood flows through the system.

- Minimize the extent and expense of structural improvements needed to reconfigure the existing flood management system.

Disadvantages

- High capital cost to construct new bypasses and acquire real estate; choosing the best locations may be difficult due to existing development.
- Potential medium to high costs for environmental obligations (including mitigation) and long-term O &M and/or vegetation management.
- Inherent system deficiencies may not be addressed.
- There could be long term changes in land use due to new construction and therefore property tax changes.
- Could increase development in the floodplain.
- Creating a new bypass requires relocating people within that area.
- Political acceptability may be low.
- May complicate sediment routing processes.

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment depending on location and extent of the bypasses (costs include real estate acquisitions, mitigation costs, and bypass construction costs).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

New O&M costs would be associated with the construction of new bypasses.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the long-term cost of flood fighting through reduction in the frequency or magnitude of flooding and diversion of high flows from reaches with insufficient channel capacity or deficient levees. However, the addition of a new bypass adds a structure to the facilities that must now be patrolled/monitored and could possibly fail in a flood.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in the frequency or magnitude of flooding.

Effect on Floodplain and Economic Development?

No direct effects; however, reduces the frequency of flooding and increases level of flood protection, which may encourage development in floodplain areas receiving benefits.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State responsibility through reduction in the frequency or magnitude of flooding due to increased channel capacity.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

New bypasses could be designed to enhance Key Physical Processes and Ecological Functions (restoring flood flows to historic flood basins or overflow areas, rehabilitating floodplain forming processes, and maintaining ecosystem in channel).

Potential for Adverse Environmental Impacts?

Constructing new bypasses would result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, including potential loss of habitat for associated special-status species; potential for minor to moderate alteration of physical processes downstream, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Creation of new habitat for floodplain-dependent species could reduce the adverse impacts of the flood management system by restoring part of the system

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for ecosystem restoration and recreation to be integrated to maximize overall project benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasibility would be highly dependent on location (real estate requirements, land uses or infrastructure affected), cost, and magnitude of benefits provided; new bypasses that provide multiple benefits would have a higher likelihood of acceptability and implementation. Creating a new bypass means relocating people within that area. Political acceptability may be low.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Bypasses could increase flows to downstream reaches; these impacts would need to be mitigated if downstream channel capacities could not accommodate increased flows. Modulation of the flow should be a major design consideration so that the volume or flow downstream of the confluence is less than that would have occur without the bypass. Bypasses may decrease flows, velocities, and sediment transport to certain reaches.

Effect on Residual Risk?

None.

Climate Change Adaptability

Constructing new bypasses could enhance hydrologic adaptability by increasing water management flexibility; could also enhance biological adaptability by increasing habitat quantity, connectivity, and complexity, thus enhancing the ability of populations to adjust to the consequences of climate change.

Construct new levees to provide flood protection to additional areas potentially affected by flooding

ID MA-020

Description

Problem

Due to changes in the land-use patterns, channel hydraulics, and environmental conditions, portions of the non-leveed channels may need new levees constructed to meet current level of safety requirements.

Desired Outcome

Improved robustness and flexibility of flood management system with the construction of additional levees.

Methodology

New levees could be constructed along river reaches where no levees are currently present to increase the carrying capacity of the existing river channel and modulate peak flows. By modifying the flow regime, new levees constructed upstream from urban areas may be an effective measure in lowering the risk of flooding. Levee construction may not be feasible in all urban areas due to the high cost of land acquisition. However, in some urban areas, there may be no other management actions capable of managing flood flows.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces the chances of inundation.
- Increases opportunities for operational flexibility.

Disadvantages

- Potentially high capital cost and long-term O&M costs.
- May result in downstream hydraulic impacts due to funneling of flows through confined channel.
- Potential for long permitting process, legal issues due to land acquisition, and high mitigation costs from environmental impacts.

- Potential for loss of habitat due to disconnection from the floodplain and changes to streamside habitat conditions.
- Potential for increased development behind levees.

Economic Considerations

Capital Cost? (High, Medium, Low)

High capital costs, dependant on location and amount of new levee construction. Costs include construction, permitting, mitigation, real estate acquisitions, and relocations.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs proportional to amount of new levee construction.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Likely reduction in flood fighting costs through reduction in frequency of flooding. However, increased length of levees would increase monitoring requirements.

Effect on Damage to Critical Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to expand State flood responsibility by increasing the project-levee system.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Substantial permanent impacts to terrestrial, riparian and shaded riverine aquatic habitats including loss of habitat for special-status species, and may cut-off species by inhibiting access to habitat areas. Substantial alteration of physical processes, including flow regime (e.g., seasonality, magnitude, and duration of flows) and sediment transport that could result in permanent impacts to habitat for aquatic and riparian species. Other permanent impacts may be possible if this management action results in increased development.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No other benefits identified.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically desirable, particularly in urban and urbanizing areas. However, high capital costs, environmental impacts, and significant land acquisitions may present a challenge to widespread implementation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

If the new levees increase the carrying capacity of the channel and constrict additional flows in the channel, downstream impacts may result, particularly in downstream areas with lower levels of flood protection. However, if new levees are used to modulate flow peaks, reduced impacts may be experienced downstream.

Effect on Residual Risk?

Reduces the frequency of flooding. May increase residual risk if floodplain development is encouraged.

Climate Change Adaptability

Constructing new levees would enhance hydrologic adaptability by increasing system capacity. However, this action would reduce biological adaptability by reducing quantity and complexity of floodplain habitats, and the continuity of these habitats along environmental gradients; and thus, reducing the ability of species to handle and adjust to the consequences of climate changeability to maintain floodplain species and habitats under more extreme conditions.

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Raise levees to improve flood system performance

ID MA-021

Description

Problem

There are existing reaches along the flood management system with insufficient freeboard to meet existing design criteria. The extents and the magnitude of the freeboard deficiencies could be further compounded by the new urban level of protection requirements.

Desired Outcome

Adequate levels of freeboard and increased conveyance capacity of the channels adjacent to levees by raising levees.

Methodology

Levees can be raised by the addition of earthen material or by constructing floodwalls. Raising levees could allow larger design flows, or larger project flows, to pass with adequate freeboard. Specific actions would take into consideration various factors, including the need to perform a geotechnical evaluation of the structural integrity of the levee for stability and seepage; and land use and corresponding level of safety needs on either side of the levee. Any modification of non-project levees that provide significant benefits or are essential to management of the system would require adoption of these structures as part of the SPFC by the Central Valley Flood Protection Board (Board) and/or the USACE.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces the chances of levee overtopping, thereby reducing risk of flooding.
- Meet existing and current design requirement for level of safety.

Disadvantages

- Potential for environmental consequences and high capital costs due enlargement of levee footprint.
- May result in downstream hydraulic impacts due to increased channel capacity.

- Raising levees and formal adoption as a federal project levee could transfer maintenance responsibility to DWR, thus increasing maintenance costs and time.
- Potential for increased floodplain development.
- Availability of right-of-way and environmental justice considerations.

Economic Considerations

Capital Cost? (High, Medium, Low)

High capital cost because raising levee will likely require acquiring additional real estate. Small levee raise (less than 2 feet) could be performed with flood walls, in which case the capital cost is relatively low.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Minimum or no significant increase in annual maintenance costs depending on height of levee raise.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Marginal to moderate decrease in flood fighting. Flood fighting cost due to insufficient freeboard are reduced, but other forms of flood fighting (boils, wavewash erosion, river erosion) are likely to remain unchanged.

Effect on Damage to Critical Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of overtopping. However, State flood responsibility may increase if the floodplain and economic development above occurs. Responsibilities to maintain facilities remain unchanged.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Raising levees could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species. This action also could moderately alter physical processes (including sediment transport) and streamside habitat conditions that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases. Floodwalls create the potential for public nuisance (e.g., graffiti).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No other benefits identified.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically desirable, particularly in urban and urbanizing areas. Real estate acquisitions may be necessary if widening the footprint of an existing levee.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Increasing the carrying capacity of the channel may result in downstream impacts, particularly in downstream areas with lower levels of flood protection. Additional flood flows that would have historically escaped channel would be conveyed downstream. Potential for higher flow velocities and associated scouring issues.

Effect on Residual Risk?

Reduces the frequency of flooding. May increase residual risk if floodplain development is encouraged.

Climate Change Adaptability

Raising levees could enhance hydrologic adaptability by increasing system capacity. However, this management action could adversely impact biological adaptability by reducing ability to for floodplain species and habitats to handle more extreme conditions.

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Construct setback levees

ID MA-022

Description

Problem

Some reaches of the flood management system have insufficient conveyance caused by restrictions in the channel and/or environmental considerations that restrict maintenance activities, reduce the natural capacity of floodplains to provide flood storage and conveyance, and can cause sedimentation and scour in unanticipated places due to changes in sediment transport dynamics. In addition, some existing levees are built on poor or unsuitable foundation, which would make retrofitting the levees unfeasible or costs prohibitively high.

Desired Outcome

Improved channel conveyance, improved level of safety, and minimized disruptions to vital riparian corridors through the construction of setback levees.

Methodology

Expanding channel capacity by setting levees back from the main river could provide a sustainable approach by enhancing flood system performance and reducing levee erosion over the longer term. Assessing setback levees would take into consideration various factors, including existing flood easements; willingness of landowners to participate in the action; site geology and topography, ground foundation; existing transportation features and infrastructure; hydraulic modeling; opportunities for habitat, recreation, and agricultural enhancement; and potential erosion reduction.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations & Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Increased floodplain storage reduces the risks and consequence of flooding, thereby reducing the State exposure to flood responsibility.
- More sustainable than traditional levees.

- Reduces O&M Costs.
- Promotes multiple benefits in addition to reduction of flood risk (habitat, recreation, open space).
- Provides the opportunity to rehabilitate and accommodate fluvial geomorphic processes and flow regimes, increase the quantity, diversity, and connectivity of riparian and wetland habitats, increased groundwater recharge, provide access for migrating fish, recreating frequently activated floodplains within a majority of the natural river system.
- Decrease the geotechnical risk factors by placing the levee on good foundation.
- Increased funding opportunities for setback levees due to environmental benefits.

Disadvantages

- Potentially high capital cost.
- May result in downstream hydraulic impacts due to increased channel capacity.
- Extensive permitting requirements.
- Land acquisitions and easements for access can be difficult.
- Potential loss of economic activity due to displacement of land uses.
- Potential for fish stranding.

Economic Considerations

Capital Cost? (High, Medium, Low)

High capital costs for real estate acquisition and new construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant increase in maintenance cost, with potential for reduced long-term costs. Reduced channel maintenance costs (vegetation management, sediment removal) and reduced scouring and erosion in comparison to traditional levees may reduce long-term O&M costs.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals, also with non-governmental organizations for habitat mitigation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Likely reduction in flood fighting costs through reduction in frequency of flooding. New levee would be constructed to current standards, minimizing the need for flood fighting operations.

Effect on Damage to Critical Infrastructure?

Reducing the risk of flooding reduces the likelihood of damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Reduces the frequency of flooding and increases level of flood protection, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding, unless floodplain development occurs.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

The construction of setback levees could rehabilitate key physical processes by reconnecting channels to historical floodplains, and enhancing sediment transport, channel and floodplain forming processes, groundwater recharge, and improving water quality, and would rehabilitate ecological functions by increasing riparian and wetland habitat area, quality diversity and connectivity, and by increasing spawning habitat (e.g., for Sacramento splittail) and salmonid rearing habitat.

Potential for Adverse Environmental Impacts?

Constructing setback levees would result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, and potentially to canal or seasonal wetland habitats, and in impacts to associated special-status species.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced. Setting back levees provides the opportunity to rehabilitate and accommodate fluvial geomorphic processes and flow regimes, reducing erosion and scouring and the need for channel maintenance.

Social Considerations

Contribution to Public Safety?

Improves level of flood protection by reducing the frequency of flooding; residual risk remains and may increase if floodplain development increases.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Can provide open space, recreation, and habitat benefits. Potential for multiple-use trail alignments and connectivity by allowing public access to top of berm.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Setback levees offer multiple benefits and are high in implementation likelihood. Improving the level of flood protection is politically desirable. There are desirable environmental benefits. However, high capital costs and land acquisition challenges may present a challenge to widespread implementation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential for downstream impacts due to increased floodplain storage capacity and channel capacity. May impact flow split if located near weirs.

Effect on Residual Risk?

Reduce flooding frequency, thereby reducing residual risk. May increase residual risk if floodplain development is encouraged.

Climate Change Adaptability

This management action would enhance hydrologic adaptability by increasing water management flexibility. This management action also could enhance biological adaptability by increasing the quantity, connectivity, and complexity of floodplain habitats and their continuity along environmental gradients; and thus, enhance the ability of species to handle and adjust to the consequences of climate change.

Construct ring levees

ID MA-023

Description

Problem

There are small communities and critical infrastructure at risk of flooding, either because they have no flood control protection or the existing flood control protection is insufficient and unreliable.

Desired Outcome

Increased level of protection for small communities and critical infrastructure.

Methodology

Reduction in flood risk to small communities and individual structures can be achieved by constructing ring levees or internal levees. A ring levee is constructed around the protected area, isolating it from potential flood waters. Internal levees, on the other hand, serve as a second line of defense by compartmentalizing and isolating portions of the protected area. Both ring and internal levees can be used as secondary lines of defense. Ring levees can also act as the primary line of defense in the absence of other forms of flood control. Ingress and egress to the area protected may be difficult if the levee is more than a few feet tall because long ramps may be required to provide vehicular passage over the top of the levee.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces the frequency of flooding for small communities and critical infrastructure.
- Could allow for greater habitat diversity outside of the ring levee.

Disadvantages

- Potential high capital costs associated with levee construction, right of way acquisition, retrofitting and/or rerouting existing utilities, roadways, and drainage.
- Potential to segregate the community, create inequalities, and limit economic growth.

- Limited funding sources for this type of construction.

Economic Considerations

Capital Cost? (High, Medium, Low)

High capital costs to obtain real estate and construct new ring levees capable of protecting entire communities.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for ring levee maintenance plus additional O&M costs for associated infrastructure (e.g., pumping stations).

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Likely reduction in long-term costs for emergency response and recovery through reduction in frequency of flooding of area surrounded by ring levee.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Likely reduction in flood fighting costs through reduction in frequency of flooding in areas surrounded by ring levees. However, in some areas, flood fighting may be impaired if the ring levee is surrounded by flood waters and no protected transportation corridors for ingress and egress are provided.

Effect on Damage to Critical Infrastructure?

Ring levees and internal cross levees will reduce the frequency of flooding, and therefore will reduce damages to critical public infrastructure located inside the ring. No impact on critical infrastructure outside of the ring levee.

Effect on Floodplain and Economic Development?

Could limit economic growth by limiting development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by reducing the frequency of flooding in the area protected by the ring levee. May increase State flood responsibility by expanding project-levee system.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Substantial permanent impacts including loss of terrestrial and potentially wetland habitat, including potential loss of habitat for special-status species, and potential reduction in habitat connectivity.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves level of flood protection by reducing the frequency of flooding in isolated areas; residual risk of flooding remains. Could make ingress and egress from ringed areas more difficult during flood events.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Levees have the potential for establishment of a recreational trail on top. Loop trails are popular and can be potentially supported by ring levees.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the level of flood protection is politically acceptable.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Little to no redirected downstream impacts for smaller ring levees. Larger ring levees may increase downstream impacts of flood events. Ring levees could cause impact to upstream areas due to backwater impacts. Internal cross levees do not affect hydraulic conveyance, but control inundation zones.

Effect on Residual Risk?

Reduce the residual risk for areas inside ring levee. May increase risk if additional development occurs inside the ring levee.

Climate Change Adaptability

This management action would reduce biological adaptability because it would reduce habitat quantity and potentially habitat connectivity, and thus, reduce the ability of species to handle and adjust to the consequences of climate change.

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Improve structural performance and resilience of existing levees

ID MA-024

Description

Problem

Existing levees in certain areas have deficiencies that increase the risks of levee failure during a high-water event. The deficiencies range from inadequate embankment geometry, seepage, and toe erosion, to foundational stability. Steep waterside slopes on levees adjacent to flows promote the development of erosion features that destabilize the levee embankment. Certain levee reaches are prone to develop severe through- and/or under-seepage problems during medium- to high-water events. Seepage through the levee embankment may induce internal erosion, surface raveling, and a destabilizing effect on the levee embankment. Under-seepage, manifested by upward flowing sand boils near and away from the landside levee toe, washes off fine-grained sediments, reduces the stability of the levee embankment and creates severe internal erosion. Both forms of seepage, if uncontrolled, may result in a levee breach. In addition, overtopping of levees during high-water events can erode the landside of the levee resulting in catastrophic breach and failure of the levee.

Desired Outcome

Reduced risk of slope or seepage failure on existing levees.

Methodology

Levees are strengthened to enhance their integrity by improving the embankment soil properties and geometry to resist slope and seepage failures. Improving levee's resistance to slope failure is achieved by enlarging levees through adding material to widen the top width, flatten steep slopes, or both. Material can be added on the landside of a levee to increase stability by widening the crown and/or decreasing the side slopes. Adding material on the waterside can be used in some situations, but is not desired because of constriction to the waterway. Methods to address seepage include seepage berms, impermeable barrier curtains (slurry cutoff wall) in the levee and/or its foundation, and relief wells and toe drains. Armoring of the landside of the levees is required to improve levee resiliency during overtopping episodes.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces the risk of levee failure and improves reliability.

Disadvantages

- Potentially high capital cost.
- Land requirements for increased levee footprint.
- Potentially increased environmental permitting and mitigation costs.
- Rip-rap placement could affect aquatic habitat.
- Does not increase capacity of channel.

Economic Considerations

Capital Cost? (High, Medium, Low)

Moderate to high initial capital costs depending on the extent and type of levee modification.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change or slight reduction in O&M costs as previous costs associated with levee repairs are minimized.

Potential for Cost-Sharing?

Opportunities to partner with USACE and locals.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Reduces emergency response and recovery costs because of improved reliability of existing flood management system, provided land uses remain unchanged.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Reduces flood fighting costs because of improved reliability of existing flood management system.

Effect on Damage to Critical Infrastructure?

Reduces damage to critical public infrastructure because of improved reliability of existing flood management system.

Effect on Floodplain and Economic Development?

No effect on floodplain development because of no change to the level of protection from improved reliability of existing flood management system.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Improved reliability of existing flood management system will reduce State financial exposure resulting from catastrophic failures.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

If the footprint of the existing levees is expanded, it could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species. It could also moderately alter physical processes (including sediment transport) that could result in permanent impacts to habitat for aquatic and riparian species. In addition, construction related activities could result in substantial permanent impacts to terrestrial habitat including loss of habitat for special-status species.

Permitting Considerations?

Extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves public safety by improving reliability of the flood management system (level of protection remains unchanged).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Improving the reliability of levees is politically desirable. However, costs and permitting considerations may present a challenge to widespread implementation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Minimal impacts. Changes to water-side slope may reduce channel carrying capacity.

Effect on Residual Risk?

No change to residual risk because there is no change to the level of protection from improved reliability of existing flood management system.

Climate Change Adaptability

Improving structural performance of levees would not enhance hydrologic adaptability because system capacity remains unchanged.

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Construct closure structures

ID MA-087

Description

Problem

Levee control systems may not be present or adequate to contain a flood event as desired in a canal, channel, or backwater slough. In some cases, this is due to crossings such as railroad tracks, roads, highways, and other at-grade penetrations throughout the system that lower the flood control structure elevation. Many of these gaps do not currently have structures installed that would be closed during periods of high water to prevent flood waters from inundating an area. In other instances, backwater channels or minor tributaries currently have perimeter levees that are expensive or impractical to improve or maintain.

Desired Outcome

Operable or permanent closure structures installed at identified gaps in flood control system alignments or across backwater channels.

Methodology

Closure structures are barriers that may be constructed as permanent barriers or as operational gates, closing and opening as needed to block floodwaters from a particular area. All gaps in the flood control system need to be identified, and local agencies would evaluate gaps without closure structures to assess whether a structure is warranted. Local agencies would also determine whether highly encroached backwater channels or minor tributaries would be better protected by cross-channel closure structures than by improving existing perimeter levees; and they would identify means to accommodate tributary inflows through other means (storage, pumping, gravity drains). New closure structures (e.g., flood gates or permanent barriers) would be constructed, as appropriate.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Constructing closure structures at flood control system gaps provides significant benefits, as a minimal structure may significantly reduce flooding potential.

- Benefit/cost ratios may be very high.
- Closure structures may be the most cost-effective means of protecting some highly encroached channels.

Disadvantages

- Time, money and coordination required to construct structures.
- Potential disruptions in transportation, recreation, and water quality.
- Potential environmental impacts depending on location and existing habitat.

Economic Considerations

Capital Cost? (High, Medium, Low)

Variable, depending on location, type, and use.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. Annual costs are associated with operational drills and upgrades to the closure structures. Some waterway closures which affect navigation and/or require pumping could be O&M intensive, however.

Potential for Cost-Sharing?

There is a potential for cost sharing with local agencies and federal flood control agencies. Federal participation will depend on legislative authorization and net benefit evaluation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No significant change. A well established protocol for operation of closure structures should be included in any emergency response plan. Although closure structures in levee gaps often block transportation routes, the routes closed would likely be impassable due to flooding without the closure structure.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease. Currently flood fighting must be exercised on system gaps that do not have closure structures, so this action would reduce flood fighting costs.

Effect on Damage to Critical Infrastructure?

Failure to effectively close gaps may result in inundation of a protected area and potential damage to any infrastructure lying within.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

While the State may not be directly responsible for the operations and maintenance of closure structures, it is in the State's interest to make sure that closure structures will successfully operate to prevent inundation during high-water events.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Minimal; however, structures across backwater sloughs or minor tributaries could reduce hazards such as fish stranding.

Potential for Adverse Environmental Impacts?

Potential for adverse environmental impact exists during construction and operation of new structures.

Permitting Considerations?

Construction, drill and/or emergency operation of closure structures may require permits and coordination with agencies and other entities affected by the structure, such as the California Department of Transportation, counties and municipalities, and rail companies. Structures to close channels/waterways would require extensive and complex permitting and consultation.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Structures to close channels/waterways would isolate historic levees and may render them unnecessary for providing protection during major flood events. In those cases, they would not be subject to strict maintenance and inspection requirements such as vegetation removal.

Social Considerations

Contribution to Public Safety?

High potential to reduce the consequences of flooding and to protect public safety by preventing inundation.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely. If a gap is identified in a flood control system, there is likely an impact to level of protection of the surrounding flood control system. Construction of a closure structure would benefit the entire flood control system and lands that are being protected.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Closing existing gaps would decrease residual risk.

Climate Change Adaptability

Backwater and minor tributary closures could provide the most cost effective way to accommodate increased main channel stages due to climate change, especially where urban encroachments on the minor channels are severe.

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Remove and/or deauthorize disconnected, redundant, and nonfunctional facilities of the SPFC

ID MA-088

Description

Problem

There are currently facilities of the SPFC that are no longer functional, disconnected from the system, and/or redundant. These facilities do not significantly contribute to the operations or function of the SPFC. However, maintenance resources continue to be committed to these facilities. Senate Bill 5 requires DWR to identify these candidate SPFC facilities for removal.

Desired Outcome

Identified candidate facilities for removal from the SPFC and a process for removal and deauthorization of these facilities.

Methodology

Identify existing facilities of the SPFC that could be strong candidates for removal from the SPFC without causing significant adverse impacts to the system, or ancillary facilities, as identified in the California Water Code. This analysis is to include the specific candidate facilities identified for potential removal, the reasons for removal, potential impacts or other implications of removal, costs of removal, and additional actions associated and/or required with removal. This would require determining the process to deauthorize levees and roles and responsibilities of the Board, DWR, and the USACE.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance.

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Promote Ecosystem Functions

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Would free up O&M resources.
- May allow for habitat restoration opportunities.

Disadvantages

- May result in localized impacts.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium. Cost of removing facilities would vary depending on disposal requirements and mitigation requirements.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Overall O&M costs would decrease.

Potential for Cost-Sharing?

Low. Removal of levees would likely be State or local responsibility. State/locals could look for cost share opportunities in current or future federal projects that require partial removal of levees.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Would reduce need for flood fighting due to removal of facilities.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Removal of facilities would reduce State responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could rehabilitate key physical processes (e.g., sediment transport balance and meander migration), floodplain and channel forming processes, and rehabilitate floodplain riparian habitat.

Potential for Adverse Environmental Impacts?

Removal of facilities could result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, and potentially to canal or seasonal wetland habitats, and in impacts to associated special-status species.

Permitting Considerations?

Extensive and complex permitting requirements

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced. Removal of facilities provides the opportunity to rehabilitate and accommodate fluvial geomorphic processes and flow regimes, reducing erosion and scouring and the need for channel maintenance.

Social Considerations

Contribution to Public Safety?

Removal of nonfunctional facilities would not affect public safety

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Would provide open space, recreation, and habitat benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely - but potential environmental impacts will be largest hurdle.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None or minimal hydraulic impacts would occur due to removal of nonfunctional SPFC facilities.

Effect on Residual Risk?

None.

Climate Change Adaptability

Could enhance hydrologic adaptability by increasing water management flexibility. This management action also could enhance biological adaptability by increasing the quantity, connectivity, and complexity of floodplain habitats and their continuity along environmental gradients; and thus, enhance the ability of species to handle and adjust to the consequences of climate change.

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4.0 Operations and Maintenance

MA-029: Restore channel form and function to improve O&M and facilitate flood damage reduction

MA-030: Perform clearing and snagging within channels

MA-031: Perform dredging to remove sediment from channels

MA-032: Reuse excess materials derived from channel maintenance

MA-033: Develop regional channel vegetation management plans

MA-034: Develop an improved encroachment management program endorsed by the State

MA-035: Improve administration and oversight of levee penetrations

MA-036: Improve interior drainage

MA-037: Protect vulnerable levees and banks through stabilization and erosion repairs

MA-038: Revise O&M manuals to be consistent with new and current policies that support multi-benefits of the flood system

MA-083: Effectively maintain, operate, and rehabilitate closure structures

MA-089: Develop and/or implement structure rehabilitation and repair program

MA-103: Develop long-term sustainable and implementable Levee Vegetation Management Strategy

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Restore channel form and function to improve O&M and facilitate flood damage reduction

ID MA-029

Description

Problem

Natural river/stream channels are formed by fairly frequent runoff events. Often, these channels are not large enough to handle peak flows from larger (less frequent) floods and upstream reservoir releases. In addition, in many cases, development has encroached into the floodplain and levee systems. This results in channels with inadequate capacity that can inhibit drainage and contribute to flooding. Narrow channels also tend to increase velocity, which can increase erosion and the risk of flood damage.

Desired Outcome

Enlarged channels to safely carry larger peak flows without causing excessive erosion or other damage to the flood management system.

Methodology

Restoring channel form and function to design standards would involve excavating a new channel or enlarging an existing channel. This would increase channel capacity and/or decrease the channel velocity. Areas adjacent to the thalweg or low-flow channel can also be used to encourage or maintain sensitive habitat while other sections of the channel prism can be maintained for flow. Restoring channel form and function could occur in an existing river channel, an existing floodway, or a transitory storage area.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- May reduce scour and erosion.
- May increase capacity.

Disadvantages

- Extensive permitting requirements.

- Temporary imperilment to aquatic and riverine ecosystems.

Economic Considerations

Capital Cost? (High, Medium, Low)

The cost of restoring channel capacity projects is mainly project dependent and would likely require a moderate level of initial investment due to permitting requirements and the need for mitigation and structural changes to the flood system.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potentially decrease in the annual costs if mechanized equipment can be readily used to clear vegetation and sediment on a more regular basis without the need to initiate large scale sediment and/or vegetation removal projects.

Potential for Cost-Sharing?

Potential for federal and local cost-sharing for channelization projects that facilitate flood damage reduction or ecosystem benefits.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No significant change in emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No significant change in flood fighting cost.

Effect on Damage to Critical Infrastructure?

Reduction in flood risk could reduce damage to critical infrastructure.

Effect on Floodplain and Economic Development?

Restoring channel capacity may improve flood system reliability and reduce risk.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Restoring channel capacity would not likely change State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Generally, restoring channel capacity does not contribute to rehabilitation of ecosystem functions. However, low flow channels can be used to encourage or maintain sensitive habitat while other sections of the channel prism can be maintained for carrying flood flows.

Potential for Adverse Environmental Impact?

This management action could result in moderate to substantial temporary (and potentially permanent) impacts to upland, riparian, and aquatic habitats, and associated special-status species, depending on the design of the action.

Permitting Considerations?

Restoring channel capacity would result in extensive and complex permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

The magnitude of adverse effects to habitats resulting from flood system O&M would be reduced if a low flow channel is incorporated into the design of the action.

Social Considerations

Contribution to Public Safety?

Improves public safety by reducing flood damages.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at the State and local levels.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel.

Effect on Residual Risk?

None.

Climate Change Adaptability

This management action could enhance hydrologic and/or biological adaptability by increasing capacity to convey flood flows, moderating damage from extreme events, and enhancing ability of habitats and species to handle (e.g., persist through or recover from) extreme events; however, effect on adaptability would depend on the design of management action.

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Perform clearing and snagging within channels

ID MA-030

Description

Problem

Snags are trees, limbs, or large bushes that have fallen into a stream or river. Once in the waterway, they can collect sediment or debris. While snags provide important ecosystem benefits (large woody debris provides excellent fish habitat), they can also migrate downstream and become stuck in the channel, which creates snag "islands" and reduces channel capacity. Snags can also cause property damage by becoming caught on bridges, pumping plants, docks, and other infrastructure. Debris also can create drag and reduce channel capacity, but in some areas may serve as bank protection. Small debris such as branches or trash can accumulate along the banks during normal flows, but while unsightly, are not a problem during large floods. Large debris can include furniture, appliances, or other large items that may have been illegally dumped into the flood channel. These items can easily be trapped on the river banks by snags, as well as by bridges or other similar infrastructure. Large debris can create significant backwater effects that reduce flood flow capacity. Some forms of vegetation in the channels can reduce flow velocities, obstruct debris movement, and increase sedimentation. Responsibility for vegetation management is ill-defined for most channels, which further complicates channel maintenance.

Desired Outcome

Maximized capacity of channels.

Methodology

Clearing and snagging could be performed to remove snags and large debris located within channels.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduced snag "islands", and increased channel capacity.
- Reduced damages to bridges, pumping plants, and other property.
- Could potentially increase channel capacity.

Disadvantages

- Extensive permitting requirements.
- Significant riverine and aquatic ecosystem impacts.
- There is a major Endangered Species Act and California Endangered Species Act conflict with removal of woody debris.
- Woody debris is important for plants in the Delta.

Economic Considerations

Capital Cost? (High, Medium, Low)

Clearing and snagging projects would likely require a low level of initial investment. The lack of structural changes to the flood system would likely keep costs down relative to other actions. However, there is high potential for litigation/mitigation related costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change; although clearing and snagging within the channel may reduce O&M costs due to reduced need for sediment removal in channels, and reduced scour and erosion repair required at levees and bridges. O&M costs may increase in some areas as well.

Potential for Cost-Sharing?

Potential for local cost-sharing for clearing and snagging within channels.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

There would likely be no significant change in costs for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No significant change in flood fighting cost.

Effect on Damage to Critical Infrastructure?

Potential to reduce scour and erosion repairs at bridges and other in channel infrastructure.

Effect on Floodplain and Economic Development?

Clearing and snagging may improve flood system reliability, but does not reduce flood risk.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Although clearing and snagging could potentially improve channel capacity, there would likely be no significant change in State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Snagging would result in moderate to substantial impacts to riparian habitat during removal and permanent impacts and loss of habitat for aquatic fish species foraging and rearing habitat including special-status species. Clearing of vegetation would result in substantial permanent impacts to riparian habitat, nesting birds, and aquatic species including special-status species.

Permitting Considerations?

Extensive permitting requirements are required for clearing and snagging.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves public safety by reducing flood damages.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Clearing and snagging may provide maintenance workers better visibility for potential problems.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Somewhat likely, but has low cost-effectiveness. In addition, this measure would reduce existing shaded riverine aquatic habitat, which is an important component to some ecosystem restoration programs.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

There is a possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel. Impacts will vary in the Delta, depending on where the changes are occurring.

Effect on Residual Risk?

No significant change.

Climate Change Adaptability

This action would reduce biological adaptability by eliminating and simplifying habitat, and thus, reducing the ability of populations to handle and adjust to the consequences of climate change; but action could enhance hydrologic adaptability if it significantly increases flood flow capacity.

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Perform dredging to remove sediment from channels

ID MA-031

Description

Problem

Sedimentation of natural channels reduces their flow-carrying capacity. Historically, hydraulic mining released great quantities of sediment into some foothill streams, which was carried into the valley and deposited wherever the gradient and flow rate no longer would support the bed load transport. Even though hydraulic mining is now discontinued, portions of these sediments remain in valley streams. Sedimentation also results from erosion of riverbanks and levees and runoff from agricultural fields. Natural sedimentation also deposits large quantities of silt, sand, gravel, cobbles, and boulders at critical points like sand traps and other low-energy areas where steep foothill streams become flat valley watercourses.

Desired Outcome

Maximized capacity of channels.

Methodology

Dredging removes sediment from channels and can improve the hydraulic efficiency. Deepening the thalweg or creating one can increase the overall flow efficiency by increasing the velocity.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Maximizes design channel capacity.

Disadvantages

- Extensive permitting requirements.
- Significant aquatic ecosystem impacts.
- Dredge tailings disposal - potential hazardous materials in sediment.
- Complex, time consuming and expensive permitting requirements.

Economic Considerations

Capital Cost? (High, Medium, Low)

Dredging projects would likely require a high level of initial investment. The need for mitigation and dredge tailings disposal would likely make costs higher relative to other actions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No significant change, although dredging may reduce O&M costs due to less scour and erosion repair.

Potential for Cost-Sharing?

Potential for local cost share in areas needing improved channel conveyance and having limited ecosystem constraints.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change in costs for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

Dredging may have little to no effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Although dredging could potentially improve channel capacity, there would likely be no change in State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

This management action would result in moderate to substantial impacts to riparian and aquatic habitat (fish spawning and rearing habitat) including special-status species. It also would result in minor to moderate alteration of physical processes, including flow regime (e.g., magnitude, and duration of flows) and sediment transport, that could result in permanent impacts to habitat for aquatic and riparian species.

Permitting Considerations?

Considerable and extensive permitting requirements; can be very costly and time consuming.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improved public safety by increasing the reliability of channels to pass flood flows.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Somewhat likely, but has low cost-effectiveness, and would need to be performed in low environmental impact areas.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Possibility for redirected hydraulic impacts due to changes in flow characteristics of the channel.

Effect on Residual Risk?

No change.

Climate Change Adaptability

This management action could enhance hydrologic adaptability if it significantly increases flood flow capacity; but, action also could reduce biological adaptability by disturbing and simplifying aquatic habitats, and thus, reducing the ability of populations to handle and adjust to the consequences of climate change.

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Reuse excess materials derived from channel maintenance

ID MA-032

Description

Problem

Waste materials are created during channel maintenance activities such as dredging and clearing and snagging. It is necessary to transport and dispose of these materials, which can be costly.

Desired Outcome

Reduced waste and transportation costs and reduced negative impacts to the environment including carbon emissions and disposal to landfills through material reuse.

Methodology

Beneficial reuses for waste materials from channel maintenance activities should be identified before dredging. Dredged sediment, if it does not contain hazardous materials, can and should be used where appropriate.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- May reduce transportation costs for disposal.
- May reduce disposal costs.

Disadvantages

- Extensive permitting requirements.
- Potential hazardous materials in sediment.

Economic Considerations

Capital Cost? (High, Medium, Low)

There is a significant cost to use and process dredge spoils. Costs may be offset by the savings in avoiding disposal and transportation costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change to operate/maintain/repair.

Potential for Cost-Sharing?

High potential for local cost-sharing to reduce overall disposal and transportation costs associated with channel maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

There would likely be no change in costs for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change in flood fighting cost.

Effect on Damage to Critical Infrastructure?

None.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Reuse of excess materials would likely provide no change in State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Potential negative environmental effects or even positive benefits - it depends on circumstances.

Permitting Considerations?

Some permits may be required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Unlikely to have substantial public safety impacts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Reuse of excess material may also reduce negative impacts to the environment including carbon emissions and disposal to landfills.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Reuse of excess materials would be highly likely to be implemented if there are potential cost savings and reduction in negative impacts to the environment.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

This management action is unrelated to hydrologic and biological adaptability.

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Develop regional channel vegetation management plans

ID MA-033

Description

Problem

When vegetation management has been deferred for several years due to funding or other constraints, excessive vegetation growth can result in the establishment of habitat that requires additional permits or mitigation before maintenance activities can be conducted. Conflicting guidance and requirements in relation to vegetation and debris management can make it difficult for local agencies with limited budgets to conduct maintenance activities efficiently.

Desired Outcome

Vegetation management plans that balance public trust concerns while maintaining the functionality of the flood management system and allow for regular maintenance.

Methodology

Architectural landscape designs should be developed in coordination with structural designs. Vegetation management plans should be developed using a collaborative process involving stakeholders.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- May improve bank stability.
- Would reduce costs of obtaining permits.
- Would provide multiple benefits along with flood risk reduction.

Disadvantages

- Conflicting policies.

Economic Considerations

Capital Cost? (High, Medium, Low)

Capital costs may be high depending on the level of vegetation management.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Regional vegetation management plans could slightly increase annual O&M costs, but would likely be offset by a reduction in permitting and mitigation costs.

Potential for Cost-Sharing?

Cost sharing is applicable only to levee vegetation management, as maintaining agencies will provide the bulk for O&M costs. The State and the federal governments should help offset these costs and provide funds and assistance to help maintaining agencies with environmental permitting.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No significant change to emergency response and recovery cost. Vegetation management will improve the reliability of the system, and may restore channel capacity

Flood Fighting Cost? (Increase, Decrease, or No Change)

Management of vegetation on levees would reduce long-term flood fighting costs, as it increases visibility and access. Vegetation on channels has an indirect and relatively minor effect on flood fighting such as tree debris in the water impacting food fighting operations.

Effect on Damage to Critical Infrastructure?

Minor effect. Vegetation debris from channels could potentially accumulate at choke points (e.g., bridge crossings) obstructing and impacting flow conveyance, negatively affecting in-channel and adjacent infrastructure. Use of a vegetation management plan could reduce debris accumulation, lessening the impact on bridges and other critical infrastructure.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change in State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Regional vegetation management could rehabilitate key physical processes and ecosystem functions, if vegetation is managed to enhance physical processes, such as sediment transport and channel and floodplain forming processes, and to enhance riparian and wetland habitat values.

Potential for Adverse Environmental Impact?

Channel specific and unknown at this time.

Permitting Considerations?

Channel specific and unknown at this time.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations

Contribution to Public Safety?

Unlikely to have substantial public safety impacts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Developing regional vegetation management plans may enhance aesthetic, recreational, and open space values within floodplains.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likelihood of implementation is highly dependent on the ability to meet guidelines while reducing permitting and mitigation costs.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Possible hydraulic impacts due to riparian vegetation removal. Changes in local flow velocities possible.

Effect on Residual Risk?

There will be a net reduction in risk.

Climate Change Adaptability

This action would reduce biological adaptability by reducing extent and quality (e.g., by reducing connectivity and complexity) of tree and shrub-dominated riparian habitats.

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Develop an improved encroachment management program endorsed by the State

ID MA-034

Description

Problem

The Board, in cooperation with the USACE, is responsible with processing, reviewing, issuing, and administrating permits for structures that encroach on project levees. The permitting process is lengthy, and is viewed by some as lacking standards. Currently there is a backlog of about 180 days for issuing permits for new structures. In addition, there are hundreds of permitted encroachments that are not properly maintained and hundreds of unpermitted encroachments. In fall 2007, DWR identified approximately 129 miles of partially obstructing and 7 miles of completely obstructing encroachments. Unmaintained or unpermitted encroachments may jeopardize levee integrity, raise the water surface level of design floods or flows, increase the damaging effects of flood flows, and impair inspection, maintenance, and flood fighting. DWR reports newly discovered unauthorized encroachments to the Board and works with maintaining agencies to abate unauthorized encroachments. Each maintaining agency is held responsible for preventing the construction of, or requiring the removal of, any illegally encroaching structures on the levee and for stopping any unauthorized modifications to the levee. However, some maintaining agencies may lack the resources to force the removal of illegal encroachments.

Desired Outcome

A streamlined permitting process, proper administration of existing permits, modernization of the permits database, and more vigorous enforcement of unauthorized encroachments.

Methodology

The State can work to improve the administration of encroachment permits by discouraging new encroachments, and by working with maintaining agencies to remove illegal encroachments, monitor compliance with permits for legal encroachments, and improve enforcement of unauthorized and under-authorized permits. The State can improve management of historic permits data by modernizing the repository of encroachment permits. In addition, encroachment permits should considered within the asset/legal-liability framework.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will reduce the number of poorly maintained and unpermitted encroachments.
- Will make inspection of levees easier by removing encroachments.
- Will shorten the permit action time.

Disadvantages

- With the large number of unpermitted encroachments, could add significant administrative work.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy management actions will tend to have a substantially lower capital cost than those that involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Potential cost-sharing with federal agencies, other State agencies, and local agencies. Before cost-sharing with other entities, the Board needs to modernize and stream line the permitting process.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Flood fighting costs would decrease with accessibility to all permits, properly categorized and spatially georeferenced.

Effect on Damage to Critical Infrastructure?

Improving the administration of encroachment permits would likely have no significant effect on damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

The encroachment permitting process needs to be part of the overall management plan.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by reducing poorly maintained and illegal encroachments.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

No change in residual risk.

Climate Change Adaptability

This management action is unrelated to hydrologic and biological adaptability.

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Improve administration and oversight of levee penetrations

ID MA-035

Description

Problem

Many levees in the Sacramento and San Joaquin river basins have locations where irrigation lines, drainage outlets, and other utilities have been piped through the levee. Some of these penetrations are engineered, but the majority are not and pose a potential threat to the integrity of the levees. Leaks through the levee resulting from the penetrations can cause excessive levee material loss. In some instances, a surface expression of the levee material loss is visible soon after the leak manifests itself, especially on sandy levee embankments. However, if the levee composition is clayey, the leak may cause internal ground loss that may not be detected until a sinkhole appears on the levee surface. These hidden voids pose a serious threat to the structural integrity of the levee, which threatens the areas protected by the levee.

Desired Outcome

An inventory of all penetrations, permitted and otherwise, creation of a database for all penetrations, and an assessment of deficiencies associated with penetrations. Safer penetrations in future installations.

Methodology

Improve administration and oversight of levee penetrations by creating a data management system to track, evaluate, and permit penetrations. Establish a protocol to periodically conduct non-invasive testing on levee penetrations to assess their deterioration and recommend an adequate course of action. Upgrade standards for construction of new penetrations (e.g., use of stainless steel pipe for portions of penetrations within the Board right-of-way).

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Continuous testing cycle can reveal penetrations that are deteriorating.
- They can be replaced before any damage to the levee embankment occurs.

Disadvantages

- Could add significant administrative work.

Economic Considerations

Capital Cost? (High, Medium, Low)

Variable depending on the extent of administrative improvements.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate. Most of the annual costs are associated with physical testing of levee penetrations that pose a hazard to flood protection.

Potential for Cost-Sharing?

Potential cost sharing with maintainers, operators, as well as State and federal agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Low to none.

Flood Fighting Cost? (Increase, Decrease, or No Change)

If deficient levee penetrations are located and are repaired or replaced, flood fighting costs should decrease as result of increased structural integrity of the levee.

Effect on Damage to Critical Infrastructure?

Repairing and replacement of deficient levee penetration will improve the levee's structural integrity and lower the risks of flooding.

Effect on Floodplain and Economic Development?

Increase in the structural integrity of the levees and thereby lowering the risks to flooding may induce further developments.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Inability of maintaining agencies to repair or replace deficient levee penetrations could increase State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Project dependent - repair on or relocation of levee penetration may have temporary impacts to riparian or other habitats.

Potential for Adverse Environmental Impact?

Repair or relocation of levee penetration may have temporary impacts to riparian or other habitats.

Permitting Considerations?

Potential for extensive permitting considerations.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Public safety benefits could come from improving levee stability by repairing or replacing deficient levee penetrations.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Knowledge of the locations of pipe encroachments leads to a better understanding of potential risks from such encroachments, leading to identification of problem locations (e.g., leaking pipes requiring retrofit/replacement), and resulting in reduced risk to the flood protection system.

Climate Change Adaptability

This management action is unrelated to hydrologic and biological adaptability.

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Improve interior drainage

ID MA-036

Description

Problem

Localized flooding can occur even while the larger conveyance paths for the mainstem rivers are performing well. Levees can block interior drainage, making channels and pumping plants an essential part of the flood management system. Flooding can occur at local scales that nest, or influence other scales. A flood of a small stream can create discharge that leads to flooding of its receiving stream or channel. Similarly a receiving channel can flood, backing up water to the point of flooding a tributary channel. Managing the potential for flooding at each scale requires direct attention at that scale and an understanding of the likely effects that can be produced in, or delivered from, watersheds of different scales.

Desired Outcome

Channeled runoff to prevent flooding, help eliminate backwater effects, and ensure each watershed has sufficient capacity.

Methodology

Interior drainage could be improved by restoring the original functionality of interior drainage systems by modifying or constructing new outfalls. For example, outfalls with flap gates can prevent backflow from rivers or channels into interior areas during high-water events. Similarly, new or improved pump stations could convey interior drainage over levees or other flow barriers associated with the flood management system. Improvements could also include constructing interior drainage detention/retention facilities to reduce or attenuate outflows to the flood management system.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation to assess the potential to provide significant systemwide flood management benefits.

Advantages

- Reduces localized, interior flooding by restoring original drainage regime existing before levee construction.
- Reduces accumulation of water behind levees.

Disadvantages

- Moderate to high capital costs.
- Potential to increase outflows to the rest of the flood management system.
- May not provide significant systemwide flood management benefits.

Economic Considerations

Capital Cost? (High, Medium, Low)

Moderate to high cost depending on specific actions/methods.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs associated with flood management system; O&M costs would fall on local entities.

Potential for Cost-Sharing?

Some opportunity for cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Probably lower incidence of flood fighting.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in frequency or magnitude of interior flooding and accumulated water.

Effect on Floodplain and Economic Development?

Better management of flood risk improves reliability of infrastructure and investments, leading to better economic development potential.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change to State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could significantly improve, be neutral, or impair ecological functions.

Potential for Adverse Environmental Impact?

Could potentially impact the environment.

Permitting Considerations?

Potential for extensive permitting requirements depending on the project.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

This management action could potentially impact O&M.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of localized, interior flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Depends on specific solutions brought forward.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Interior drainage is typically a local function and implementation would depend on local resources, needs, and acceptability.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Little potential to increase downstream flood flows by increasing outflows from interior areas; timing of increased outflows unlikely to coincide with flood system peak flows. Careful consideration must be given to maintaining retention/detention basins.

Effect on Residual Risk?

None.

Climate Change Adaptability

Unrelated.

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Protect vulnerable levees and banks through stabilization and erosion repairs

ID MA-037

Description

Problem

In many levee reaches, the flood control channels were designed to flush out sediments that accumulated in the Sacramento River system from hydraulic mining activities in the late 1800s. These designs altered the natural balance of erosion and deposition in the channels and flushed out vast quantities of the mining debris. The flows are now eroding the natural channel banks and the flood protection levees placed on them. Furthermore, many of the earlier levees were not engineered and were made with readily available materials dredged from the adjacent river. Poor levee foundations, geometry, or soil materials in some areas have further exacerbated under-seepage, erosion, and stability problems. Without bank protection, erosion can encroach on existing levees and ultimately result in levee failure and major flooding. Floodwaters are erosive and, while moving along typically unprotected levees, need only encounter one weak spot in the system to cause a breach and potential loss of life or property. Extremely high hydraulic gradients can find other weak spots in the foundation materials and begin to migrate, or erode material from the foundation, creating unstable conditions quickly followed by total or significant structural failure. This ongoing erosion causes more damage than can be repaired by the State or maintaining agencies using standard maintenance programs.

Desired Outcome

A long range solution to perform proactive repairs on damaged sites exhibiting signs of under seepage, erosion, or instability, so they do not reach a critical state of failure.

Methodology

River erosion repair and bank stabilization, particularly when done in emergency situations, are made using rock riprap to armor and stabilize the bank. If conducted as part of an ongoing inspection and maintenance program, erosion repair and bank stabilization can be made more environmentally friendly by re-examining current geomorphic processes, and including sloping riparian benches with vegetation on the bench for bank stabilization and riparian habitat. Instream habitat, such as log and debris structures to direct flows away from the levees could also be created as part of these repair activities.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Improves levee performance.
- Provides greater flood protection.

Disadvantages

- Temporary damage to aquatic and riverine ecosystems.
- Complex, time consuming and expensive permitting
- Funding normally only available during a flood event, when a facility is in eminent danger.

Economic Considerations

Capital Cost? (High, Medium, Low)

Protecting vulnerable levees and banks through stabilization and erosion repairs has a medium to high cost due to structural changes and potential mitigation as compared to other actions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Protecting vulnerable levees and banks through stabilization and erosion repairs can decrease annual operations and maintenance costs due to better performing levees and less erosion to repair in the future.

Potential for Cost-Sharing?

Potential cost-sharing with federal agencies, other State agencies, as well as local agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Protecting vulnerable levees and banks through stabilization and erosion repairs may slightly decrease the response and recovery costs due to better performing levees.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Repairing damaged sites will decrease flood fighting costs.

Effect on Damage to Critical Infrastructure?

Region-specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

No direct effects; however, by increasing the stability of the levee, would reduce the frequency of flooding and increase level of flood protection, which may encourage development in the floodplain

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Relative to likely future conditions, may reduce the frequency of flooding, thereby could reduce State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Levee repairs that include riparian habitat benches and instream habitat elements would rehabilitate ecological functions, by increasing SRA cover and enhancing migration corridor habitat for fish and wildlife species.

Potential for Adverse Environmental Impact?

Depending on implementation, this action could result in potential temporary and permanent impacts to shaded riverine aquatic and riparian habitats including potential habitat loss for special-status species. Planting of native riparian vegetation could offset some of these impacts. Bank stabilization reduces available Bank Swallow habitat, and has been the primary cause of the imperilment of the population along the Sacramento River.

Permitting Considerations?

Extensive permitting requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

There is potential for reducing adverse environmental impacts.

Social Considerations

Contribution to Public Safety?

Likely to improve public safety due to improved levee performance.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Unlikely to provide other benefits besides improved levee performance and maintenance.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at State level.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

There is potential for redirected hydraulic impacts.

Effect on Residual Risk?

Residual risk will decrease.

Climate Change Adaptability

This management action would increase hydrologic adaptability by moderating potential damage, and could increase or decrease biological adaptability depending on existing habitat conditions and design of individual actions (e.g., extent of riparian and aquatic habitat removed vs. added), which together would determine the effect on habitat extent, connectivity, and complexity.

Revise O&M manuals to be consistent with new and current policies that support multi-benefits of the flood system

ID MA-038

Description

Problem

Outdated O&M manuals do not reflect the best maintenance practices to inspect, operate, and maintain levees most effectively. Many existing O&M manuals were prepared specifically to reduce flood risks, often with little consideration about how those O&M activities might affect other functions of the flood management system, including ecosystem functions.

Desired Outcome

O&M manuals reflecting best maintenance practices and a science-based approach to multi-benefit management of the flood management system, compliant with current laws and regulations.

Methodology

Revise O&M manuals, or provide an addendum to O&M manuals that promote best maintenance practices using the best available scientific and technical data to support multiple objectives and ecosystem benefits. The revised O&M manuals should be complimentary to the multiple-benefit systemwide flood management plan. While keeping public safety, flood system functionality/efficiency priorities, O&M manuals should not conflict with other uses of the system, such as water supply or ecosystem health. O&M documents should be reviewed and updated to reflect current maintenance intervals, laws, regulations, and policies. Levee inspection criteria should be modified or tiered based on the type of land use protected by the levee (urban, rural, or agricultural). Existing inspection criteria should be strengthened to include determination and location of non-standard levee sections and to implement repairs and/or replacements. Identify best management practices to prevent and minimize encroachments.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained; look for opportunities to combine with management actions involving setback levees, ecosystem restoration, and floodplain storage.

Advantages

- Establishing the framework for O&M of the flood control works in conjunction with public trust issues may lower cost.

Disadvantages

- Conflicting policies.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low to medium, depending on the number of manuals that need to be, and can be, updated to achieve these goals. Costs will include stakeholder engagement, modeling and assessment of different approaches, and finalizing the improved manuals. Revision of O&M manual may require congressional and State legislation to redefine the State-federal flood management for California.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Updating O&M manuals can decrease costs to operate/maintain/repair the flood system, as the revised manuals will better reflect existing conditions. Over the long-term revisions could result in an increased workload and cost implications to the FMO office.

Potential for Cost-Sharing?

Potential for cost sharing with local agencies and Federal flood agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Updating O&M manuals to reflect existing conditions has potential to reduce flood frequency and decrease emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce the frequency (and long-term cost) of flooding.

Effect on Damage to Critical Infrastructure?

Region-specific (cannot determine at this time).

Effect on Floodplain and Economic Development?

Potential increased pressure from development if the risk of flooding is decreased.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Improved O&M has the potential to reduce the frequency (and long-term cost) of flooding. No significant change of effect on State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Including the enhancement of physical processes and ecosystem function in O&M could rehabilitate those processes and functions, because currently multiple objectives are not optimized in O&M, which generally has a single flood management focus.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations

Contribution to Public Safety?

Potential to reduce frequency of flooding and improve level of flood protection by updating O&M manuals.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreation, open space, and water supply benefits. Review of O&M criteria would also be an opportunity to evaluate potential benefits to recreation and fish and wildlife enhancement that could persist after flood season is over.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential; however, concerns over limiting the flexibility to maintain integrity of the flood management system must be overcome.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential upstream and downstream hydraulic impacts if new O&M manuals call for altered flow regimes and storage requirements.

Effect on Residual Risk?

May reduce the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability

This management action could increase biological adaptability by increasing opportunities to provide habitat, or increase habitat quality (e.g., by increasing connectivity or complexity), and thus, sustain populations under a range of conditions, including extreme flow events.

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Effectively maintain, operate, and rehabilitate closure structures

ID MA-083

Description

Problem

The levee control system is not a continuous embankment with a well-defined and established levee crown elevation throughout. Throughout the system, levees are interrupted by crossings and other at-grade penetrations that lower the top-of-levee elevation. Such crossings include railroad tracks, roads, and highways. Many of these levee gaps are fitted with structures that would be closed during periods of high water to prevent inundation of the protected area. Other gaps do not have such closure structures. Some closure structures installed have not been maintained to allow functional operation during flood events.

Desired Outcome

Closure structures that function effectively during flood events.

Methodology

Existing closure structures need to be evaluated for deficiencies in design and maintenance and need to be operated on a regular basis to make sure they will operate effectively during emergencies. The structure operators and affected transportation corridors must be identified. The State could establish closure structure operation drill and inspection protocols to be carried out by local structure operators.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Effective in preventing inundation.

Disadvantages

- Time, money and coordination required to activate and erect the structures.
- Disruption in transportation.
- Not fully tested to withstand flood flows and prevent inundation until major flood event.

Economic Considerations

Capital Cost? (High, Medium, Low)

Closure structures costs are potentially high to design and install.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Very low. Annual costs are associated with operational drills and upgrades to the closure structures.

Potential for Cost-Sharing?

Potential for cost sharing with local agencies and federal flood agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Criteria and a well established protocol for activation of closure structures should be included in any emergency response plan. Although closure structures often block transportation routes, which may be used for evacuation, coordinating structure operations protocol with emergency response plans is likely to reduce the need for or frequency of evacuations.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Flood fighting must be exercised on system gaps that do not have functional closure structures, so this action would reduce flood fighting costs.

Effect on Damage to Critical Infrastructure?

Failure to effectively close gaps may result in inundation of a protected area and potential damage to any infrastructure lying within.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

While the State may not be directly responsible for the O&M of closure structures, it is in the State's interest to make sure that closure structures will successfully operate and close off levee gaps to prevent inundation during high-water events.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

There may be project-dependent environmental impacts.

Permitting Considerations?

Drill and/or emergency operation of closure structures may require permits and coordination with agencies and other entities affected by the structure, such as the California Department of Transportation, counties and municipalities, and rail companies.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

High potential to reduce the consequences of flooding and to protect public safety by preventing inundation.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Very likely. Existing closure structures may need to be upgraded and all need to be operated on a regular basis. The USACE requires that all closure structures be in good condition and that trial erections have been accomplished in accordance with related O&M manuals.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Recognizing gaps in the system and ensuring operation of closure structures will decrease the residual risk.

Climate Change Adaptability

Unrelated.

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Develop and/or implement structure rehabilitation and repair program

ID MA-089

Description

Problem

Several of the structures of the SPFC are aging and approaching the end of their useful life. Many of the new maintenance and repair programs now in place only focus on those programs that have USACE operation, maintenance, repair, replacement, and rehabilitation reports filed. There is a need to include the aging structures under one unified rehabilitation and repair program.

Desired Outcome

To have a structure rehabilitation and repair program to monitor and rehabilitate aging structures.

Methodology

Create a program that monitors the status of existing structures and repairs those structures that have been identified as beyond their useful life.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Monitoring existing structures would enable DWR to prioritize rehabilitation efforts, and respond to potential problems sooner.

Disadvantages

- Developing a monitoring program of this magnitude could be very costly.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium to high. Developing a monitoring program could be very costly depending on number of structures included in program, and ease of accessibility.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. The development of a rehabilitation and monitoring program will increase repair costs.

Potential for Cost-Sharing?

There is a potential for cost sharing with local agencies and federal flood control agencies. Federal participation will depend on legislative authorization and net benefit evaluation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical infrastructure by rehabilitating aging structures.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

None.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Potential for adverse environmental impact exists during rehabilitation of structures. However, the rehabilitation of structures would reduce the risk of environmental impact due to failure or inoperability.

Permitting Considerations?

No direct impacts.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely, if supported by the State.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk.

Climate Change Adaptability

Unrelated.

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Develop long-term sustainable and implementable Levee Vegetation Management Strategy

ID MA-103

Description

Problem

In some areas, the vegetation on levees can prevent adequate visual inspections from occurring, and present access challenges. In addition, some areas of legacy levees with large wood vegetation present a challenge in implementing O&M functions to conform with all existing laws and regulations. Levee vegetation requires a management strategy for a balanced approach to support both public safety and environmental protection. The current allowable site-by-site variances are limiting and require significant resources to gain approval.

Desired Outcome

A levee vegetation management strategy that focuses on a balanced approach to support both public safety and environmental protection. Current studies have found no direct scientific evidence to support the complete clearing of vegetation on levees. Continued research into improving the science behind levee vegetation management would be desirable.

Methodology

Create a levee vegetation management strategy that focuses on enforcing visibility and accessibility criteria, and develops a life-cycle monitoring and maintenance strategy for vegetation using a collaborative process among stakeholders. Some parts of the State-federal flood protection system in California's Central Valley have limited vegetation, and the State will continue to maintain those levees in that fashion. New levees being added to the system (such as setback levees, backup levees, and ring levees) will also be designed, constructed, and maintained to limit the vegetation on the levees. However, the "legacy levees" built immediately adjacent to California's major riverine systems present unique challenges that will require other management strategies. A regional variance with a broader geographic extent would be more efficient than a site-by-site variance process.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Clear, implementable guidelines for maintaining agencies to follow that are consistent with California's Central Valley Flood System Improvement Framework.

Disadvantages

- Requires Board approval for the basis of a balanced approach.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy management actions will tend to have a substantially lower capital cost than other management actions which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate increase in inspection costs, depending on the adoption of a new set of inspection criteria. Maintenance costs may also be impacted depending on the final adopted set of inspection criteria.

Potential for Cost-Sharing?

Federal participation may not be forthcoming, however it could result in the eligibility for federal funding for future repairs.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Would likely have no significant change in flood fighting cost.

Effect on Damage to Critical Infrastructure?

Reduction in flood risk could reduce damage to critical infrastructure.

Effect on Floodplain and Economic Development?

Not likely to have an effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change in State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

A new levee vegetation management strategy would have less environmental impacts than complete vegetation removal. Reductions would be site-specific.

Social Considerations

Contribution to Public Safety?

Likely to improve public safety due to improved levee maintenance performance via increased visibility and accessibility for inspections.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at the State, local, and federal resources regulatory agency levels.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

This management action could enhance hydrologic and/or biological adaptability by increasing capacity to convey flood flows, moderating damage from extreme events, and enhancing ability of habitats and species to persist through or recover from extreme events.

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5.0 Ecosystem Functions

MA-039: Manage runoff through watershed management

MA-042: Remove unnatural hard points within and along channels

MA-043: Develop hazardous waste and materials management protocols to identify, contain, and remediate potential water quality hazards within floodplains

MA-044: Operate reservoirs with flood reservation space to more closely approximate natural flow regimes

MA-045: Reduce the incidence of invasive species in the flood management system

MA-046: Remove barriers to fish passage

MA-047: Set back levees to connect rivers to floodplains

MA-091: Restore channel alignment (i.e., conduct de-channelization)

MA-092: Encourage natural physical geomorphic processes, including channel migration and sediment transport

MA-093: Improve the quality, quantity, and connectivity of floodplain, wetland, riparian, woodland, grassland, and other native habitat communities

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Manage runoff through watershed management

ID MA-039

Description

Problem

Runoff from watershed source areas has increased, in varying extents, due to increases in impermeable surfaces in developed areas, soil compaction from agriculture, reductions in vegetative cover, incision of stream channels, and losses of wetlands. Runoff from flood events may worsen in the next 50 to 100 years, as regional temperatures rise and winter precipitation falls more frequently as rain, rather than snow. The increased intensity and frequency of winter flooding may overwhelm the existing flood management system on a more regular basis, unless other efforts are taken.

Desired Outcome

Improved watershed management to enhance ecosystem function and attenuate downstream runoff, reduce the rate and magnitude of runoff during precipitation events, and reduce the need to store runoff in large reservoirs. Restoration of natural communities and wetlands, additional water storage, improved water quality, and increased flexibility for water management throughout the system.

Methodology

Local watershed projects would focus on increasing soil permeability, vegetative cover, the area of wetlands, and the connectivity between stream channels and floodplains. DWR could provide technical assistance or funding support to local agencies on such projects. Additionally, the State could work with land management agencies and local planning agencies in watersheds to reduce the extent of compacted or impermeable surface, reduce the likelihood of catastrophic wildfires, and increase overall vegetative cover. This will increase percolation and water retention rates across broader areas and reduce the need for more expensive downstream options. Other supporting activities at the State level could include developing requirements for updating relevant land-use plans in upper watersheds to protect and increase the area of wetlands, and passing legislation governing subdivision standards. Plans would be updated to increase vegetative cover, expand wetland areas, restore meadows, install drywells to convert surface runoff to groundwater recharge, “daylighting” concrete-lined or culverted drainage channels, and minimize the area of compacted or impermeable surfaces.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other actions involving setback levees
- Provides environmental, flood risk reduction, recreation, and water quality benefits.
- Reducing runoff results in erosion reduction and reduction of sediment transport.
- Reduces the peak stormwater runoff and decreases the frequency and consequences of flooding.
- Potential contributions to all CVFPP goals.
- Potential to increase additional storage and water management flexibility (in case where upper watershed management results in storage of water in forests/meadows).

Disadvantages

- May reduce potential tax bases of local jurisdictions by limiting development.
- May have indirect effects on water rights.
- May reduce property taxes if conducted on private lands.
- Uncertainty regarding amount of flood reduction benefits.

Economic Considerations

Capital Cost? (High, Medium, Low)

The costs to modify the policy would be relatively low. However, capital costs associated with implementation of the policy could be low to relatively high depending on to the extent of physical construction. Some of this cost could be shifted to developers responsible for urbanization. Preservation of upper watershed may involve right of way costs for easement agreements and protracted negotiation with landowners, water right holders, and reservoir operators.

Capital costs of projects would likely be offset by reduced ongoing operations and maintenance, repair, and mitigation and other permitting requirements in the long term.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Improved upper watershed management will reduce the total and peak volume of stormwater discharged to the flood system and associated accelerated erosion and decrease the annual cost for operations and maintenance or repair.

Potential for Cost-Sharing?

Potential cost-sharing with local land-use planning agencies for general plan modifications, federal and other State agencies, and various non-governmental organizations, and private developers for project development and implementation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Reducing peak stormwater runoff reduces the frequency and consequences of flooding; thereby reduces long-term costs of emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Reducing peak stormwater runoff reduces the frequency of flooding; thereby reduces long-term costs of flood fighting. There could also be some reduction in flooding in the upper watershed.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure by reducing the frequency and magnitude of flooding.

Effect on Floodplain and Economic Development?

Revised land-use plans may inhibit future floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

May reduce the frequency of flooding, thereby reducing State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Upper watershed land management actions could rehabilitate key hydrologic processes in downstream areas by establishing a more natural hydrograph while attenuating peak flows, recharging groundwater, increasing the growing season, and increasing habitat benefits. Upper watershed management actions may also result in passive recreation benefits. Groundwater recharge of streams may help maintain instream flows and critical water temperatures for over-summering salmonids as well as improve of aquatic and upland habitats within the watershed.

Potential for Adverse Environmental Impacts?

No direct effects, but the physical construction of wetland areas, drywells (underground structures that dispose of unwanted water), setback levees, etc. could have some impact.

Permitting Considerations?

No direct effects, but implementation of the policy would require permitting which could be minor to substantial depending on the project that was implemented. May also provide mitigation credits.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Minimal; the improvement of upland portions of watersheds would likely result in a reduction in sediment loads will reduce the impacts associated with downstream flood maintenance.

Social Considerations

Contribution to Public Safety?

Improves public safety by reducing the frequency and magnitude of flooding. In addition it will reduce the maintenance on downstream channels and facilities along the valley floor.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to enhance recreation and open space values. Potential for water supply benefits by increasing infiltration to groundwater. Potential to improve water quality by increasing use of wetlands as natural filters.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely acceptable at the State level; local implementation may face challenges as implementation could restrict development. However, this management action would likely be implemented in forested public lands which do not have high potential for urbanization. Local funding may also be a challenge.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Minimal; this action may reduce the total and peak volume of water and sediment discharged to the flood system.

Effect on Residual Risk?

This action may reduce peak stormwater runoff, potentially decreasing the frequency and consequences of flooding.

Climate Change Adaptability

Implementation of the policy created by this action may enhance hydrologic adaptability by reducing the magnitude of potential flood flows, and thus reducing flood risk and moderating potential damage; this enhancement of hydrologic adaptability would also enhance biological adaptability by increasing the amount and complexity of habitat and its continuity along environmental gradients, and by reducing the consequences of extreme events. Additionally, carbon sequestration could increase with wetland creation and other vegetation community type enhancement.

Remove unnatural hard points within and along channels

ID MA-042

Description

Problem

Unnatural hard points in or on the banks of a river (such as bridge abutments, rock revetment, dikes, limitations on channel boundaries, or other physical encroachments into a channel or waterway) can affect the hydraulics of river channels, constraining dynamic natural fluvial geomorphologic processes of erosion, deposition, and channel meander that contribute to healthy and sustainable ecosystems.

Desired Outcome

Promotion of natural physical processes that support essential ecosystem functions within the flood management system.

Methodology

Changing the physical features of the conveyance system by removing hard points, such as rock revetment, dikes, or other structures in the river, can improve ecosystem functions by promoting natural erosion and deposition processes, aquatic and terrestrial habitat heterogeneity, and successional habitat development. However, removing hard points should be commensurate with replacement of a feature that affords like function (e.g., level of protection, water management, vehicular passage), and must not restrict operability or maintainability of the flood protection works. Riparian, wetland, shallow water, and terrestrial habitats could be integrated into this measure in ways that do not reduce flood flow capacity. In some cases, removal, modification, or relocation of hard points can also contribute to flood damage reduction by reducing constrictions or improving channel capacity. Implementation could also incorporate vegetation types or features that improve or facilitate O&M of the flood management system.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Improves natural geomorphologic processes (deposition, erosion, meander).

- Supports self-sustaining ecosystem functions (transitional or successional habitat).
- Potential to reduce flood risk if coordinated with actions that remove channel constrictions and improve conveyance.
- Rip rap removal combined with riparian forest restoration can promote controlled bank erosion, providing the process to directly incorporate large woody habitat into the aquatic environment.
- May affect water supply reliability.
- May reduce redirected scour and erosion.

Disadvantages

- Would need to be implemented in ways that do not impact levee or flood system integrity (erosion, meander) or beneficial structures such as fish screens.
- Potential loss of federal cost-sharing for bank protection and PL 84-99 accreditation if implementation cannot be shown to maintain existing level of protection.
- Would need to be implemented in ways that do not impact transportation or interstate commerce (e.g., removal and replacement of selected bridge abutments).

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-high initial investment depending on number, location, and types of hard points and treatments implemented. Low, where the end result can be accomplished by simply eliminating maintenance and repair.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to increase maintenance and repair costs if the action leads to erosion on or near flood management facilities. Alternately, could reduce maintenance and repair costs over time if erosion and other factors are considered and accounted for as part of implementation. Also, will represent a large cost savings where bank revetment has no direct affect on flood risk reduction.

Potential for Cost-Sharing?

Potential for federal cost-sharing via contributions to existing federal project purposes (environmental restoration). Additional cost-sharing must be commensurate with potential loss of existing federal cost-sharing for bank protection (Sac Bank).Other cooperative cost-sharing opportunities could also be explored (e.g., tribes, non-governmental agencies).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease or eliminate response and repair costs where revetment is no longer maintained, but must not jeopardize PL 84-99 eligibility.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Encroachments may obstruct visibility or restrict the use of some flood fighting methods. Not likely to positively affect flood fighting.

Effect on Damage to Critical Infrastructure?

Cannot determine at this time (site-specific).

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential increase in liability if not combined with actions to reduce flood conveyance constrictions and strengthening of levees. Responsibility will be reduced by removing maintenance and repair of bank revetment that does directly contribute to reducing flood risk.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Reducing flow constrictions and hard points would rehabilitate physical processes, including sediment transport and channel forming processes, and would improve aquatic and riparian habitat as a result of enhancing physical processes (particularly if habitat is incorporated into action).

Potential for Adverse Environmental Impacts?

Potential construction impacts (temporary or permanent) associated with physical removal of hard points; however, these impacts would be offset by long-term environmental benefits of the action.

Permitting Considerations?

Substantial, but streamlined. If placement of these features are reduced, permitting may decrease over time.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Habitats that have been affected by flood system construction and operations and maintenance would be rehabilitated to the extent possible considering the need for future maintenance.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety, including safety of recreational activities, if combined with actions to reduce flood flow constrictions (increase flood system capacity) and address erosion of flood management features. Potential to decrease public safety if commensurate level of protection cannot be achieved, continued maintenance is not possible, and PL 84-99 accreditation is lost.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

May improve aesthetics and recreation.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Removal of hard points has been advocated by local governmental bodies and landowners who share in the cost and responsibility of maintaining revetment that does not reduce flood risk.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

If removal of hard points increases channel capacity, could result in hydraulic impacts downstream. May also provide beneficial hydraulic affects by allowing more flexibility within system.

Effect on Residual Risk?

Potential to impact downstream flow rates and weaken existing levees increasing overall flood risks. But may improve overall conveyance by providing more flexibility within system.

Climate Change Adaptability:

Removing hard points may allow for more natural adaptability to climate change.

Develop hazardous waste and materials management protocols to identify, contain, and remediate potential water quality hazards within floodplains

ID MA-043

Description

Problem

Flooding can impair water quality through the mobilization of hazardous materials or contaminants on floodplains. These materials or contaminants may originate from mines, feedlots and other agricultural runoff, fuel tanks, septic systems, landfills, illegal dumping, or other sources. In addition, flooding events following prolonged dry periods may result in increased water quality impacts from pollutants in the watershed being carried by the runoff. Also, increased runoff during the flood season that temporarily inundates floodways in areas known to have high levels of mercury may also impact water quality by increasing methylmercury levels. Specific examples include selenium runoff in San Joaquin County, mercury in Cache Creek Basin, scattered commercial entities such as feedlots, and illegal activities such as methamphetamine labs.

Desired Outcome

Protocols to manage (identify, contain, and remediate) hazardous waste and materials in the floodplain.

Methodology

Coordinate with State water boards to develop protocols outlining ways to identify, contain, and remediate potential water quality hazards before a flood event. Additional research would be needed to identify potential water quality hazards. Containment and remediation would be dependent upon the type and location of hazards found.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Works in conjunction with other actions that increase river connection to floodplains.

- Promotes multiple benefits including ecosystem services, water supply, and public safety.

Disadvantages

- Does not directly reduce the risk of flooding.
- Costs for hazardous waste removal could be high.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy management actions will have a substantially lower capital cost than other management actions which involve structural modifications. Example of capital investments include: Funding for planning activities; Funding for communication system upgrades, etc. Some testing/monitoring may be required for protocol/plan development. Potential for increase in up-front capital cost if areas known to have hazardous materials are treated or cleaned prior to flood event. The cost to contain and remediate hazardous materials could be substantial, depending on the type and location of materials.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Development of the new protocols will lead to no change in the annual cost to operate/maintain/repair the flood management system.

Potential for Cost-Sharing?

Potential for cost-sharing with U.S. EPA and California Department of Toxic Substance Control. Additional potential for coordination with ongoing total maximum daily load projects.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change in emergency response costs, but potential decrease in recovery costs due to reduced level of hazardous materials in sediment deposited by floodwaters.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change. This action will not change the frequency of flooding and will have no effect on flood fighting costs.

Effect on Damage to Critical Infrastructure?

May reduce the concentration of hazardous materials in sediment deposited on infrastructure during flood events.

Effect on Floodplain and Economic Development?

This action may result in land-use restrictions and restrictions on industrial activities within the floodplains.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

By developing protocols that would decrease the potential for spread of contaminants from flooding, this action would likely decrease State flood responsibility if responsibility for specific areas of known or potential sources of contamination can be identified prior to flood events.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Would indirectly contribute to rehabilitation of key physical processes and ecological functions by developing protocols for known highly contaminated areas and cleaning up those areas. Once a protocol is approved and addressed, and the contamination is cleaned up, contamination as a direct result of flooding would be reduced. This could therefore increase use of floodplains and flood basins for flood management by reducing hazards and obstacles to the use of that land.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

There are no expected permitting considerations for the development of the protocols; however, permits would be required if remediation is necessary.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

This management action would inform maintaining agencies of potential for hazardous materials and provide protocols for addressing them. The information developed could be used to plan for operations and maintenance and repairs to the system.

Social Considerations

Contribution to Public Safety?

This management action would enhance public safety by reducing human health risks from hazardous materials mobilized by flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

This management action would improve water supply by potentially reducing the loading of contaminants; reducing contaminants could also improve recreational opportunities within the system by reducing interaction with toxic materials.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Existing programs to reduce contaminant loading to rivers have publicized this issue, improving its probability of political and institutional acceptance. However, there is potential for political concerns if protocols affect existing industries operating on floodplains.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Not applicable.

Climate Change Adaptability

This management action would enhance biological adaptability by reducing an adverse effect of larger flood events on water quality and aquatic and riparian species. Protocols addressing hazardous materials could provide decision makers with tools to adapt to the changing inundation regimes that may result from climate change.

Operate reservoirs with flood reservation space to more closely approximate natural flow regimes

ID MA-044

Description

Problem

Reservoir operators manage storage and releases for many competing uses. By altering flow regimes, the same dam that attenuates flood peaks and protects public safety also alters downstream hydrologic processes in ways that may be incompatible with supporting viable ecosystems within the system streams. Current operations may reduce habitat complexity, limit habitat access for aquatic and terrestrial species, and alter the in-stream flow regimes necessary to sustain floodplain and riparian habitat. By reducing seasonal flow fluctuations, system reservoirs can contribute to channel aggradations, thus reducing channel capacities; the establishment of invasive species; and restricted available habitat necessary for species survival (e.g., the absence of seasonal flows that would, under natural conditions, flush fine sediment and redistribute bed sediment that is used by spawning anadromous species).

Desired Outcome

Reservoirs operated on a seasonal basis to support ecosystem needs while also protecting water supplies and allowing adequate reservoir storage space for flood management.

Methodology

Coordinate with ecosystem managers to discern ways in which ecosystem processes can be better supported by non-emergency reservoir operations, while still managing storage space for necessary water supply and flood management. The releases should optimize the duration, timing magnitude, and frequency of flows needed to sustain viable ecosystems and the inundation of floodplain habitat currently connected to streams within the flood system. Changes in releases must also accommodate necessary flood maintenance requirements. Channel maintenance may benefit from flushing flows, which could assist with vegetation management and snag removal, while also serving ecosystem needs. Consider integrating State and federal recovery goals for fish species in plans for altering flow regimes.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Promote Ecosystem Functions

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other actions involving floodplain reconnection, instream habitat, conjunctive management, and wetland creation.
- May improve system adaptability in response to climate change.

Disadvantages

- May be politically/institutionally difficult to implement.
- Unlikely to be feasible year-round or drought years.
- Likely to affect short- and long-term water supply reliability and cost.
- May affect recreational opportunities at reservoirs and river downstream.
- May increase flood maintenance responsibilities.
- May increase downstream flooding.

Economic Considerations

Capital Cost? (High, Medium, Low)

Highly variable capital costs associated with modifying dam outlet features or constructing auxiliary spillways.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

This action may decrease hydropower benefits, increase the net annual cost to operate/maintain/repair.

Potential for Cost-Sharing?

Potential for cost-sharing with federal dam operators.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change in emergency response and recovery costs, as altered flow regimes would likely be constrained to avoid increasing the frequency of flooding.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change in flood fighting costs, as altered flow regimes would likely be constrained to avoid increasing the frequency of flooding.

Effect on Damage to Critical Infrastructure?

No effect on damage to critical infrastructure, as altered flow regimes would likely be constrained to avoid increasing the frequency of flooding.

Effect on Floodplain and Economic Development?

The increased flows would not be flood flows and thus are unlikely to significantly affect floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No effect on State flood responsibility, as altered flow regimes would likely be constrained to avoid increasing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Operating reservoirs to more closely approximatenatural flow regimes would rehabilitate key physical processes and ecosystem functions by reducing scour and deposition of sediment, by providing appropriate flows for fish migration, rearing and spawning, and by providing opportunities for establishment of native riparian tree species such as cottonwoods and willows. Changes in flow could also change position of X2 (upstream distance from the Golden Gate Bridge of salinity in the Delta) with associated benefits for fisheries, and more variables flows could help prevent establishment of invasive species.

Potential for Adverse Environmental Impacts?

Yes if all natural flow regimes, including summer flows are approximated.

Permitting Considerations?

Permits for reoperation would be substantial. Permitting with FERC would be required.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Likely to reduce environmental impacts.

Social Considerations

Contribution to Public Safety?

No change to public safety, as altered flow regimes would likely be constrained to avoid increasing the frequency of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreation and fisheries benefits by changing the flow regime. Potential for avian benefits as well as preserved open space. Potential for fish and wildlife enhancement.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

May face political and institutional opposition, as existing release patterns provide hydropower and water supply benefits to current users of the system. Implementation will require demonstrating that altering system operations will not hydraulically impact the flood flow regime or increase risks.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Will alter flow patterns downstream of dams.

Effect on Residual Risk?

No change to residual risk, as reoperation would likely be constrained to avoid increasing the frequency of flooding.

Climate Change Adaptability

This action would increase biological adaptability by increasing habitat complexity, connectivity, and continuity along environmental gradients; and thus, increasing the ability of species to handle and adjust to the consequences of climate change (e.g., extreme events). However, more precipitation in the form of water may force larger releases in the rainy season.

Reduce the incidence of invasive species in the flood management system

ID MA-045

Description

Problem

Invasive species have spread through the flood management system, causing problems for both ecosystems and flood management. Past and continuing introduction of aquatic, riparian, and upland invasive species can reduce the effectiveness of flood management facilities by decreasing the channel capacity; increasing rate of sedimentation; and increasing maintenance costs. Nonnative, invasive plant species that are especially detrimental to native ecosystems are widespread within the study area where they often out-compete native plants for light, space, and nutrients, further degrading habitat quality for native fish and wildlife. Introductions of nonnative and invasive species have contributed to a decline in the number and function of native wildlife and plant communities. The Central Valley and Sacramento-San Joaquin Delta (Delta) now contain an unknown number of nonnative species (many of which are aquatic invertebrates), and a new species is estimated to be introduced at least every 14 weeks.

Desired Outcome

Reduced or controlled invasive species. Increase in native species within the flood management system. Cost savings and increased success from using a systemwide approach to control invasive species. Updated regulations to use native species for revegetation efforts within the flood system and reduce incidence of nonnative species.

Methodology

Revise and update regulatory standards (Section 131 of [CCR] Title 23, Division 1, Chapter, 1 Article 8) to prohibit introduction of nonnative species in flood management system. Define nonnative species and invasive species potentially detrimental to recovery of native riparian species (e.g., brown-headed cowbird). Define and prioritize lists of invasive species of concern: plants, wildlife, fish species, and invertebrates. Prioritize these by potential threat impacts (e.g., use California Invasive Plant Council’s weed list to determine which nonnative species are most toxic and which are relatively more benign). Coordinate plans and management efforts with ongoing planning efforts within the flood system, including CALFED Ecosystem Restoration Program, DFG California Aquatic Invasive Species Management Plan, and DFG Quagga and Zebra mussel control projects. Initiate efforts to coordinate a regional approach to invasive species control, including drafting a plan framework, a basic monitoring approach, and an approach to identifying long-term funding mechanisms. Initiate nonnative plant species mapping within and adjacent to water channels. Use best management practices for invasive species control. Use only native species for restoration projects in revegetation projects and hydroseeding, and use approved weed-free materials for erosion control. Remove nonnative species from approved lists in the current Board system regulatory standards (Article 8, Section 131), and substitute a list of appropriate local native species.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other management actions involving ecosystem restoration and channel maintenance.
- May provide mitigation credit to offset impacts from maintenance.
- Can build off existing statewide invasive control efforts to increase success and cost-effectiveness.

Disadvantages

- May take five or more years to materialize benefits.
- May result in downstream hydraulic impacts.
- Little control over adjacent areas that may cause recurrence of invasive species.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low-to-medium. Lower costs relative to structural improvements, but potentially higher costs related to permitting, maintenance, mapping, and technical evaluation on how to control invasive species from the flood management system. Costs will depend on the level of invasive infestation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase in the annual maintenance budget will be needed to control the spread of invasive species. Additional funding will also be needed to develop channel specific management plans and evaluate complete removal and prevention of future infestation of invasive species. There may be initial increase funding needs for native species planting to reduce future invasive from returning. In the long-term, systematic and regional approach and invasive removal would result in cost savings due to reduced O&M. Additionally, may reduce the incidence of wildfires and associated costs.

Potential for Cost-Sharing?

Potential for cost-sharing with other State and federal ecosystem restoration programs, local non-governmental organizations, and maintaining agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Reducing the quantity of invasive plants within the flood system has the potential to increase channel capacity and decrease the frequency of flooding. This would lead indirectly to decreased emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Reducing the quantity of invasive plants within the flood system will provide responder greater visibility to monitor the channels and respond proactively to prevent flooding (levees that are not choked with vegetation allow for application of more flood fighting techniques). Reduced vegetation will also improve channel capacity decreasing the risk of flooding thereby decreasing potential costs associated with the need for flood fighting.

Effect on Damage to Critical Infrastructure?

Region-specific, but may be planned and implemented systematically.

Effect on Floodplain and Economic Development?

Unlikely to have effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to increase the State's responsibility because control and eradication needs to a component of the overall channel management plan that include areas or reaches outside of the State-federal flood protection works.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Reducing the spread of invasive plants would rehabilitate key physical processes and key ecosystem functions, because some invasive plants obstruct flow and sediment transport, cause excessive channel and bank erosion, by deflecting current, and compete with native vegetation for light, water, and nutrients and provide little or no habitat value for native wildlife species. Active management of the channels to reduce obstructions to flow and improve the sediment transport will improve channel conveyance and minimize channel and bank erosions. Improvements on flood management system should include consideration of rehabilitation of key physical processes and ecosystem functions where feasible.

Potential for Adverse Environmental Impacts?

Use of herbicides may be necessary to control some invasive species.

Permitting Considerations?

Permitting requirements would be ongoing.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Yes. The magnitude of adverse effects to habitats resulting from flood system operations and maintenance would be reduced.

Social Considerations

Contribution to Public Safety?

No direct effects, but increasing channel capacity by removing some invasive plant species may reduce the frequency of flooding, and thus improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for enhanced recreation, wildlife, and fisheries benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically and institutionally acceptable.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential to increase flow velocity, and/or increase capacity where invasive plants are removed.

Effect on Residual Risk?

Potential to increase channel capacity and reduce residual risk.

Climate Change Adaptability

This action enhances biological adaptability by reducing the displacement of native vegetation, which both reduces a potential adverse consequence of climate change and enhances the ability of native species to handle and adjust to the consequences of climate change by reducing the loss of habitat and its continuity along environmental gradients. Restoring channels to a more natural state will enhance their adaptability to climate change.

Remove barriers to fish passage

ID MA-046

Description

Problem

Major valley rim dams that are part of the flood management and water supply systems in California have rendered 80 percent to 90 percent of the historic spawning and rearing habitat inaccessible to all fish for more than 50 years. In addition, flood bypasses also cause fish passage and entrainment issues. The dams were built without the mandated fish passage facilities required under the California Fish and Game code, and hatcheries were established to offset the impact. Hatcheries have caused declines in the genetic diversity of the salmon and steelhead populations. Without access to historic upper watershed habitats, these populations will continue to decline in quality and quantity, particularly if climate change reduces the amount of cold water available to release below these major dams. By not allowing fish upstream from these major facilities, the costs of maintaining cold water below the dams in the hotter valley floor will become prohibitively high. Historic upstream habitats will be the only suitable habitat available that will not have future osts as significant as the current operations of the major rim dams.

Desired Outcome

Improved fish passage within the flood management system without impacting public safety or limiting other water management strategies. New passage past the major rim dams to provide access to remaining cold water spawning and rearing habitats upstream in the higher elevation watersheds. Improved passage at other barriers in the system such as water diversions, culverts, etc. Improved water management options for water supply and flood release strategies to improve system sustainability and reliability in the face of climate change.

Methodology

Identify physical barriers that inhibit fish passage within the flood system and acknowledge their substantial contribution to the decline of the populations. Evaluate opportunities for enhancing fish passage through these obstructions, including installation of fish ladders or removal of the structures. Coordinate existing fish passage removal programs with other State and federal programs. Implement feasibility studies to assess and test ladder options and other ideas for passage around dams. Planning for future sustainability of water supplies and better flood operations at dams would require serious consideration of passing anadromous fish upstream from dams into the remaining historic habitat. Other barriers in the system may also be modified/removed. Bypasses could include a low-flow channel to allow passage and egress of entrained fish.

Contributes Significantly to CVFPP Goal:

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s):

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained):

Retained. Evaluate or combine with management actions involving setback levees and floodplain storage.

Advantages

- Substantial ecosystem benefits.
- Improved fisheries.
- Potential for reduced regulatory restrictions.
- Potential for increased flexibility in water supply management.
- Potential to improve public safety by reducing flooding upstream of barriers.

Disadvantages

- Medium-to-high capital cost.
- Politically sensitive.
- Short-term construction cost during implementation.
- Landowners may resist reintroduction of listed species in areas where they have not been in many years.
- Impacts early rules implemented to protect upstream habitat and fish.
- Potential to reduce storage capacity at reservoirs or prevent facilities from meeting their design capacity.
- Complex agreements needed for water management.
- Complex, costly, and lengthy permitting process.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-high. Removal or modification of fish passage barriers may entail significant initial capital cost associated with demolition, construction, and restoration activities. Additionally, there will be costs associated with reoperation of water management for deliveries and usage that will require adoption of agreements from various parties (private, local, State and federal).

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

The removal of some barrier structures are unlikely to change annual cost to operate/maintain/repair. Many structures provide no flood control benefits, and their removal would not dramatically impact operations and maintenance of the flood system. However, flood management dams would require some new operations and maintenance for fish ladders or similar structures for fish passage, increasing cost. Operations and maintenance would increase over current facilities operations and maintenance costs. These costs could be offset by water costs savings in delivery options and management flexibility and potential for less water delivery restrictions with increased fish populations and access to other beneficial habitat upstream of major dams.

Potential for Cost-Sharing?

Potential for cost-sharing with agencies with existing fish passage barrier removal programs, such as the California Coastal Conservancy, the DFG, CALFED, and NOAA Fisheries Services. Potential for cost-sharing with landowners impacted by erosion resulting from these barriers.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change; although, there is the potential to decrease frequency of flooding and improve level of protection upstream of barriers.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change; although, there is the potential to decrease frequency of flooding and improve level of protection upstream of barriers.

Effect on Damage to Critical Infrastructure?

Region-specific.

Effect on Floodplain and Economic Development?

Little to no effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Removing fish migration barriers would rehabilitate key ecological functions by enhancing salmonid migration and access to spawning habitat. Major economic and ecological benefits to the State and potentially economic interests beyond California and the Central Valley. Access to spawning and rearing could increase.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Substantial but less complex. Would require permitting under Section 404 and Section 401 of the federal Clean Water Act and consultation with the USFWS and DFG under the respective endangered species acts. There may be potential political issues with the removal of fish barriers (from local farmers and other who use these structures), but it may be popular with regulators.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

The magnitude of adverse effects to habitats resulting from flood system operations and maintenance would be reduced. Substantial savings to operations and maintenance environmental obligations with recovery of endangered species fish populations.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by reducing flooding upstream of barriers. May provide improved options for flood management strategies.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide recreational fisheries benefits. Major water supply and economic benefits could be realized by implementing passage at major dams through improve water supply reliability, improved ecosystem functions and habitat conditions, and improved conditions for commercial, recreational, and tribal salmon fishing industry.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Removal or modification of smaller fish passage barriers is likely to be more politically and institutionally acceptable than removal of larger barriers. Removal of large flood control and water supply dams and weirs may face stronger political and institutional resistance. Landowners may resist reintroduction of listed species in areas where they have not been in many years.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Removal of barriers could result in reduced upstream flooding; increased velocities and sediment loads downstream of barriers, And better flood and water supply management flexibility through the years. Installation of fish ladders would not result in redirected hydraulic impacts.

Effect on Residual Risk?

Reduces residual risk to existing development upstream from barriers.

Climate Change Adaptability

This action would increase biological adaptability by increasing the amount, connectivity, and variety of habitat available to fish species, and thus, increasing the size of fish populations and their ability to handle and adjust to the consequences of climate change. Allowing salmon and other fish access to upper watersheds above current barriers may become an essential management action as conditions on the valley floor deteriorate. This is the only major opportunity to provide major adaptation strategies at major dams that will allow for accommodating climate change and still protect public trust resource populations.

Setback levees to connect rivers to floodplains

ID MA-047

Description

Problem

Construction of levees immediately adjacent to streams, continual bank protection and channel stabilization not only reduces floodplain storage capacity resulting in larger downstream flooding, but can also severely modify natural geomorphic processes such as erosion, deposition, and channel meandering. Construction of levees also limits the area available for riparian forest development resulting in loss of riparian habitat and associated terrestrial species, shaded riverine habitat, and large woody debris; reduces groundwater recharge; and limits insect availability for foraging fish. Channelization leads to higher flushing flows moving sediments and gravels out of the system resulting in a loss of material to be used by salmonids. Loss of river connection to floodplains also results in the loss of the shallow water overland flooding that periodically takes place, which provides foraging and rearing habitat for young salmonids and splittail, allows for greater groundwater recharge, and provides foraging habitat for wintering shorebirds, waterfowl, and other terrestrial species.

Desired Outcome

Expanded flood system footprint to reconnect floodplains, increase detention and attenuate flood flows, reduce downstream flood risks, minimize O&M costs, and restore critical habitats.

Methodology

Identify areas where levees could feasibly be breached or set back from the existing low-flow channel. Leverage existing knowledge and ongoing projects to identify opportunities for setting back levees.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other management actions involving ecosystem restoration, transient storage, and land-use planning.
- Provides multiple benefits.
- Flood control projects with substantial habitat restoration components may ease permitting and mitigation requirements.
- May provide suitable land for mitigation banking.

Disadvantages

- Implementation may be limited in areas with extensive floodplain development.
- Potentially high costs of land acquisition.
- Potential loss of farmland.
- Potential loss of property taxes.
- Large projects would require extensive regulatory review and compliance.

Economic Considerations

Capital Cost? (High, Medium, Low)

High. Setting back levees may have a large capital cost associated with land acquisition and physical construction. May be a good option for rural areas to obtain adequate flood protection.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

This action is likely to decrease the annual cost to operate/maintain/repair by reducing stress on levees and attenuating flood flows.

Potential for Cost-Sharing?

Potential for cost-sharing with local flood control agencies, federal, and non-governmental organizations.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding therefore reducing the frequency of emergency response and associated costs for recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding and costs associated with fighting floods.

Effect on Damage to Critical Infrastructure?

Constructing setback levees can decrease stresses on the levees by attenuating flood flows thereby increasing the existing level of protection afforded and lowering the potential for flooding and costs associated with damages to infrastructure.

Effect on Floodplain and Economic Development?

This management action will place floodplain land inside of the footprint of the flood system, reducing the land available for future floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decreases State flood responsibility by increasing the conveyance capacity between levees and reducing flood frequency.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Would rehabilitate key physical processes by reconnecting channels to historical floodplains, and enhancing sediment transport, channel and floodplain forming processes, groundwater recharge, and improving water quality, and would rehabilitate ecological functions by increasing riparian and wetland habitat area, quality diversity and connectivity, and by increasing spawning habitat (e.g., for Sacramento splittail) and salmonid rearing habitat. Vegetation restoration of the area between the setback the river channel allow for re-introduction of native riparian species along the river corridor. This habitat benefits the wildlife that traditionally used the area and allows for connectivity between publically-managed wildlife areas along the river corridor.

Potential for Adverse Environmental Impacts?

Constructing setback levees could result in moderate to substantial permanent impacts to terrestrial and agricultural habitats, and potentially to canal or seasonal wetland habitats, and in impacts to associated special-status species; however, the resulting benefits of reconnecting the river to the floodplain could outweigh the impacts.

Permitting Considerations?

Flood control projects with substantial habitat restoration components may ease permitting and mitigation requirements. Large projects however, would require extensive regulatory review and compliance. Extensive habitat restoration may also provide suitable land for mitigation banking.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

The magnitude of adverse effects to habitats resulting from flood system operations and maintenance would be reduced. The availability of restored habitat resulting from setback levee projects could be used to provide mitigation for future projects streamlining the permitting for those future projects.

Social Considerations

Contribution to Public Safety?

Improves public safety by increasing the conveyance capacity between levees and reducing flood frequency.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to provide substaintial water supply, recreation, and open space benefits. Reconnecting rivers to floodplains in low-risk areas provides an opportunity to increase groundwater recharge, improve water quality in a long-term sustainable way at relatively low costs. Active flood plains and associated wetlands can temporarily store floodwaters, filter nutrients and impurities from runoff, process organic wastes, capture high sediment loads outside of the main flood channel, and moderate water temperature fluctuations. Construction of new linear features, such as setback levees, should always be considered for use as trail corridors, especially to connect existing trails or destinations of interest such as waterways and wildlife viewing areas.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political and institutional acceptability is likely to depend on local jurisdictions. May face resistance from landowners who face loss of land.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

May result in redirected hydraulic impacts upstream, but this may be minimized by designing setback levees to accommodate high roughness value.

Effect on Residual Risk?

Reduces the frequency of flooding, reducing residual risk to existing development.

Climate Change Adaptability:

This action would enhance hydrologic adaptability by increasing capacity to convey flood flows; and this action would increase biological adaptability by increasing habitat quantity, connectivity, complexity, and continuity along environmental gradients, and thus, increasing the viability of populations and their ability to adjust to and handle the consequences of climate change (e.g., extreme events). The addition of riparian forest would provide greater carbon sequestration and assist in meeting DWR's climate change goals, and would allow the system to better adapt to sea level rise without increasing flood risk due to greater channel capacity.

Restore channel alignment (i.e., conduct de-channelization)

ID MA-091

Description

Problem

In many areas, channels have been straightened to increase the capacity and flows. Channel straightening has eliminated adjacent habitat and often requires hardened structures to protect the bed and banks of the channel, thus further eliminating habitat.

Desired Outcome

Restored alignment of channels that have been straightened to increase natural meanders and lateral bed and bank of the channel without sacrificing the sustainable operability and maintenance of the flood protection works or increasing the flood risk.

Methodology

Identify and evaluate sites where de-channelization may be feasible. Wherever possible, match these areas with locations that will meet other CVFPP goals. De-channelization will provide additional flood storage capacity to the system. Typically, de-channelization requires an increased footprint to provide the channel room to meander. Thus, any de-channelization must consider potential conflicts with existing urban and agricultural uses, local zoning regulations, local economies, private property rights, and water rights. This may be mostly applicable to smaller tributary streams.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Look for opportunities to combine with management actions involving habitat restoration and/or floodplain storage.

Advantages

- Improves natural geomorphologic processes (deposition, erosion, meander).
- Will complement actions to develop transient floodplain storage for flood risk reduction.

- Reduces the peak stormwater runoff and decreases the frequency and consequences of flooding.
- Promotes multiple benefits (which could include flood risk reduction, groundwater recharge, water quality and ecosystem restoration).
- Potential to provide mitigation credits to offset operations and maintenance and flood project impacts.
- May reduce conflicts between maintenance and vegetation.

Disadvantages

- Potential for de-channelization may be limited in areas with extensive urban floodplain development.
- Potential impacts to existing floodplain uses.
- Potential high costs for land acquisition and/or land or floodway easement acquisition.
- May restrict operations and maintenance (e.g., timing of maintenance could be limited due to species issues).

Economic Considerations

Capital Cost? (High, Medium, Low)

Cost factors include real estate acquisitions, relocations, costs for permitting, design, construction, and mitigation, and loss of property taxes.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase short-term, and decrease long-term. Operations and maintenance costs may increase during the establishment period. Once a channel is restored, costs could decrease overall. The meandering channel could attenuate flood peaks, potentially easing strain on downstream flood protection structures. Increased vegetation within the dechannelized stream may reduce the volume of sediment deposited downstream and the need for dredging resulting in lowered costs.

Potential for Cost-Sharing?

Yes. Potential for cost-sharing with federal, State, local, and non-governmental agencies interested in habitat restoration, as well as with maintaining agencies in need to offset maintenance impacts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change. Because any de-channelization would be constrained by the requirement to not compromise design flows or increase flood risk, there would likely be no major change in costs for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No major change short term, and decrease long-term. Any de-channelization would be constrained by the requirement to not compromise design flows, obstruct visibility or interfere with flood fighting, there would likely be no major change in flood fighting costs. However, with reduced pressure on levees, costs may be reduced over time.

Effect on Damage to Critical Infrastructure?

Any linkage would be location specific and therefore unpredictable if the location is not known.

Effect on Floodplain and Economic Development?

De-channelization typically requires acquiring land adjacent to the channel. This would affect existing and potential future uses of those lands (prevent future urban development). This may have negative impact on local economies, although an increase in the wildlife habitat and recreation opportunities may be an economic benefit.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential increase, if this action is combined with creation of transitory storage, which may increases the State's areas of responsibility. Adding area for natural channel meanders would increase the floodplain, which has a natural capacity for flood storage, which can help attenuate flood peaks and reduce both peak stages and velocities in adjacent river channels.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

De-channelization would rehabilitate key physical processes and ecological functions of the channel. This would in turn benefit multiple native riparian vegetation and wildlife species including special-status species. There would also likely be other associated benefits to water quality, etc.

Potential for Adverse Environmental Impacts?

Unable to determine at this time, as they would be site-specific and dependent upon current land uses and habitat existing in adjacent lands. Construction activities and grading associated with this measure could have minor to moderate, temporary impacts (and potentially permanent impacts). However, these impacts may be offset by the benefits associated with de-channelization.

Permitting Considerations?

Varies depending on the magnitude of the project. There is a possibility to provide advance mitigation credits thereby streamlining the permitting process. Could reduce permitting related to operations and maintenance practices over time.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

May reduce operations and maintenance needs over time. Habitat improvement projects can provide mitigation opportunities for habitat losses elsewhere in the flood management system.

Social Considerations

Contribution to Public Safety?

Benefits would depend upon the size of the effort. De-channelization would likely result in an increase in floodplain area. Floodplains have a natural capacity to attenuate floods and reduce the frequency of flooding thus, improving public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Yes. Potential to contribute to groundwater recharge and potential for water supply benefits through detention of flood water and natural contaminant filtering. Increasing active flood plains and associated wetlands could result in benefits to water quality due to temporarily storing floodwaters, filtering nutrients and impurities from runoff, processing organic wastes, and capturing high sediment loads outside of the main flood channel. There are potential benefits to recreation also.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential implementation challenges are related to changes in existing and potential future land uses, land acquisition, and responsibilities for long-term maintenance of restored habitat. Additionally, habitat creation projects have to compete for scarce financial resources, so implementation may be slow due to tight budgets.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No change. As de-channelization would be constrained by the requirement to not compromise design flows, there would likely be no major change in upstream hydraulic impacts.

Effect on Residual Risk?

No change. As de-channelization would be constrained by the requirement to not compromise design flows, there would likely be no major change in residual risk. There is a possibility that implementation may reduce residual risk downstream by attenuating flood peaks.

Climate Change Adaptability

This action would enhance hydrologic adaptability by increasing water management flexibility and would enhance biological adaptability by improving habitat connectivity and increasing habitat quantity to sustain population viability. Carbon sequestration abilities would also increase.

Encourage natural physical geomorphic processes, including channel migration and sediment transport

ID MA-092

Description

Problem

Natural channel processes such as erosion, deposition, channel migration, formation of natural channel features (e.g., point bars, oxbow lakes), and sediment transport have been restricted by various flood management projects and O&M throughout the flood management system.

Desired Outcome

A comprehensive approach to emphasize and prioritize projects and other actions that encourage natural physical processes, where permitted facilities are protected or relocated.

Methodology

Evaluate the effects of past actions on the physical processes of the flood management system. Identify areas that may be suitable for restoration of these processes. Consider systemwide physical processes when proposing new projects including levee strengthening/repairs, bank erosion control, setback levees, dredging, gravel augmentation, channel alignment restoration, and large-scale vegetation planting and removal.

Contributes Significantly to CVFPP Goal

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Look for opportunities to combine with management actions involving setback levees, habitat restoration, and/or floodplain storage.

Advantages

- Improves natural geomorphologic processes (deposition, erosion, meander).
- Will complement actions to develop transient floodplain storage for flood risk reduction.
- Reduces the peak stormwater runoff and decreases the frequency and consequences of flooding.

- Promotes multiple benefits (which could include flood risk reduction, groundwater recharge, water quality and ecosystem restoration).
- Provide potential mitigation credits to offset operations and maintenance and flood project impacts.
- May reduce bank maintenance related to erosion.
- May reduce maintenance conflicts.

Disadvantages

- Implementation may be limited in areas with extensive urban floodplain development.
- Potential impacts to existing floodplain uses.
- Potential high costs for land acquisition and/or land or floodway easement acquisition.
- Potential high costs to protect or relocate existing permitted facilities.
- Natural channel processes may impact the integrity of levee systems, weirs and flood relief structures.
- Likely cause reduction in tax base for local economies.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-high. Cost factors include real estate acquisitions, relocations, costs for permitting, design, construction, and mitigation, and loss of property taxes.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase short-term, and decrease long-term. Operations and maintenance costs may increase during the establishment period. Over the long-term, operations and maintenance costs would decrease overall. A meandering channel that is allowed to function naturally could attenuate flood peaks, potentially easing strain on downstream flood protection structures.

Potential for Cost-Sharing?

Yes. Potential for cost-sharing with federal, State, local, and non-governmental agencies interested in habitat restoration, as well as with maintaining agencies in need to offset maintenance impacts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change. Because evaluation and/or restoration of physical processes would be constrained by the requirement to not compromise design flows or increase flood risk, there would likely be no major change in costs for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change short-term, decrease long-term. Any evaluation and/or restoration of physical processes would be constrained by the requirement to not compromise design flows, obstruct visibility or interfere with flood fighting, there would likely be no major change in flood fighting costs. However, with reduced pressure on levees, costs may be reduced over time.

Effect on Damage to Critical Infrastructure?

Any linkage would be location specific and therefore unpredictable if the location is not known.

Effect on Floodplain and Economic Development?

Restoration of physical processes would likely require space for the river to move. This would affect existing and potential future uses of those lands. This may have a negative impact on local economies although an increased benefit for tourism and potentially increased benefit to other lands through higher level of flood protection.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential increase, if this action is combined with creation of transitory storage, which may increase the State's area of responsibility. Adding area for natural channel meanders would increase the floodplain which have a natural capacity for flood storage, which can help attenuate flood peaks and reduce both peak stages and velocities in adjacent river channels.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Restoration of physical processes may have more widespread benefits rather than only localized. It would also result in improvements to ecological functions of the channel. This would in turn benefit multiple native riparian vegetation and aquatic and terrestrial wildlife species including special-status species. There would also likely be other associated benefits to water quality, etc.

Potential for Adverse Environmental Impacts?

Likely minor-to-moderate, temporary impacts and potentially permanent impacts. However, these impacts may be offset by the benefits associated with habitat creation/restoration. Fish stranding would need to be a design consideration to avoid impacts to special-status and native fish species. Possibility of mercury methylation depending on the location and type of wetland creation. Impacts may be offset by the benefits associated with restoration of physical processes.

Permitting Considerations?

Varies depending on the magnitude of the project. There is a possibility to provide advance mitigation credits thereby streamlining the permitting process. Could reduce permitting related to operations and maintenance practices and conflicts between vegetation and maintenance.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

May reduce operations and maintenance needs over time. Habitat improvement projects can provide mitigation opportunities for habitat losses elsewhere in the flood management system. Could reduce permitting related to operations and maintenance practices and conflicts between vegetation and maintenance.

Social Considerations

Contribution to Public Safety?

Benefits would depend upon the size of the effort. The larger the effort the greater the benefit. Restoration of physical processes may result in an increase in floodplain area. Floodplains have a natural capacity to attenuate floods and reduce the frequency of flooding thus improving public safety. Could reduce pressure on levees.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Yes. Potential to contribute to groundwater recharge and potential for water supply benefits through detention of flood water and natural contaminant filtering. Increasing active flood plains and associated wetlands could result in benefits to water quality due to temporarily storing floodwaters, filtering nutrients and impurities from runoff, processing organic wastes, and capturing high sediment loads outside of the main flood channel. Potential benefits to recreation, also.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential implementation challenges related to changes in existing and potential future land uses and land acquisition.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No change. Any restoration of physical processes would be constrained by the requirement to not compromise design flows, there would likely be no major change in upstream hydraulic impacts. This would need to be further evaluated to ensure no disruption to system operations such as weirs and bypasses.

Effect on Residual Risk?

No change. Any restoration of physical processes would be constrained by the requirement to not compromise design flows, there would likely be no major change in residual risk.

Climate Change Adaptability

This action would enhance hydrologic adaptability by increasing water management flexibility and would enhance biological adaptability by improving habitat connectivity and increasing habitat quantity to sustain population viability. Carbon sequestration abilities would also increase.

Improve the quality, quantity, and connectivity of floodplain, wetland, riparian, woodland, grassland, and other native habitat communities

ID MA-093

Description

Problem

Native habitat types within the flood management system and its associated floodplains have been lost, fragmented, and degraded.

Desired Outcome

Habitat established without sacrificing the sustainable operability and maintenance of flood protection works or increasing the flood risk. Increased riparian forest restoration, leading to greater carbon sequestration and reducing our impact on global climate change.

Methodology

Identify and evaluate areas to increase the quality, quantity, and/or diversity of wetland, riparian, and/or other native habitat. Identify effective approaches to improve habitat and ecosystem processes that also benefit a variety of important species. Identify candidate areas that are most suitable for restoring habitat and while also meeting other CVFPP goals as part of other flood projects or operations. Habitat restoration and creation must consider potential conflicts with existing urban and agricultural uses, local zoning regulations, local economies, private property rights, and water rights. Habitat enhancement and creation should be considered on a regional basis (e.g., through establishment of a mitigation bank). Habitat creation or enhancement could be completed in areas where levees are currently set back from the low-flow channels of rivers (such as along reaches of the Feather, Yuba, Sacramento, and American rivers, and to a lesser extent, in the Delta). Or, this could include reconnecting historical floodplains by expanding the current flood corridor through removal or modification of embankments, levees, or other features that prevent flood flows from entering floodplains (e.g., lowering levee crowns to permit overflows at certain flood stages, constructing weirs or other features to control the passage of flood flows into adjoining floodplains, or removing embankments completely). The bypass system of the lower Sacramento River offers extensive opportunity for wetland habitat improvements.

Contributes Significantly to CVFPP Goal:

- Promote Ecosystem Functions

Potentially Contributes to CVFPP Goal(s):

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained):

Retained. Look for opportunities to combine with management actions involving maintenance, setback levees, and floodplain storage.

Advantages

- Will work well in conjunction with management action involving setback levees and land-use planning.
- Will complement actions to develop transient floodplain storage for flood risk reduction.
- Promotes multiple benefits (flood risk reduction, groundwater recharge, water quality and ecosystem restoration).
- Provides potential mitigation credits to offset operations and maintenance and flood project impacts.
- May improve bank stability.
- Provides greater flexibility to adapt to changing climate conditions.
- May help offset climate change effects of carbon dioxide in the atmosphere.
- Potential to improve the levee stability by limiting erosion and absorbing turbulence.

Disadvantages

- Implementation may be limited in areas with extensive urban floodplain development.
- Depending on type and location of wetland creation, methylation of mercury may occur.
- Potential impacts to existing floodplain uses.
- Potential high costs for farmer compensation and/or land or floodway easement acquisition.
- Critical infrastructure modifications may also result in large costs.
- May restrict operations and maintenance (e.g., timing of maintenance could be limited due to species issues).
- Inadequate maintenance may lead to upstream hydraulic impacts due to reduced channel capacity.
- Could create debris that causes downstream hazards to boater safety and clogs dams and bridges.

Economic Considerations

Capital Cost? (High, Medium, Low)

Highly variable depending on the type of effort. Cost factors include real estate acquisitions, relocations, costs for permitting, design, construction, and potential loss of property taxes.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase short-term, and decrease long-term. Increased monitoring and maintenance of restored wetlands may moderately increase the annual cost to operate/maintain/repair the flood system, especially during the establishment period. This will depend on the site-specific situation. Currently unvegetated facilities may require increased costs for managing vegetation consistent with flood risk reduction goals. In other cases increased vegetative cover may improve bank stability and reduce erosion rates, reducing the repair costs. Wetlands can detain floodwaters and attenuate flood peaks, potentially easing strain on downstream flood protection structures. Increased vegetation throughout the flood system may reduce the volume of sediment deposited downstream and the need for dredging resulting in lower costs.

Potential for Cost-Sharing?

Yes. Potential for cost-sharing with federal, State, local, and non-governmental agencies interested in habitat restoration, as well as with maintaining agencies in need to offset maintenance impacts. Potential to leverage local volunteer labor for projects.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change, but possible decrease long-term. Because any habitat creation would be constrained by the requirement to not compromise design flows or increase flood risk, there would likely be no major change in costs for emergency response and recovery. There is a possibility that costs could be reduced. Wetland and floodplain habitat creation may decrease emergency response and recovery costs by detaining floodwaters in wetlands and attenuating flood peaks downstream.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No major change likely. As any habitat creation and enhancement would be constrained by the requirement to not compromise design flows, obstruct visibility or interfere with flood fighting, there would likely be no major change in flood fighting costs. However, increasing the extent of vegetation in locations with setback levees may decrease the level of protection of the levees and may have some upstream hydraulic impacts. These impacts are likely to be minor due to the siting of the setback levees. Additionally, there may be a decrease in flood fighting costs by detaining floodwaters in wetlands and attenuating flood peaks downstream.

Effect on Damage to Critical Infrastructure?

Could put additional strain on infrastructure not originally designed to withstand seasonal flooding (e.g., bridges, buried pipelines, electrical transmission towers, cell towers).

Effect on Floodplain and Economic Development?

This will depend on the type and nature of the project. Creation and restoration of native habitat could affect existing and potential future uses of those lands (e.g., prevent future urban development). This may have a negative impact on local economies, although an increase in the wildlife habitat and recreation opportunities may be an economic benefit. If wetland creation is part of advance mitigation planning it may facilitate floodplain development elsewhere within the flood system by streamlining mitigation processes. There is also a possibility to limit seasonal agricultural activities depending on the location. Additionally, impacts to the flood management system's ability to pass flows may occur, depending on the character and location of the project.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential increase, if this action is combined with creation of transitory storage, which may increase the State's area of responsibility. Wetlands and floodplains have a natural capacity for flood storage, which can help attenuate flood peaks and reduce both peak stages and velocities in adjacent river channels.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Increasing the quality, quantity and diversity of native habitat types within the flood system could rehabilitate key physical processes and ecological functions. The restoration of these habitat types will benefit multiple native riparian vegetation and wildlife species including special-status species.

Potential for Adverse Environmental Impacts?

Likely minor to moderate, temporary impacts and potentially permanent impacts. However, these impacts may be offset by the benefits associated with habitat creation/restoration. Fish stranding would need to be a design consideration to avoid impacts to special-status and native fish species. Possibility of mercury methylation depending on the location and type of wetland creation.

Permitting Considerations?

Varies depending on the extent and nature of habitat projects. These may include NEPA, CEQA, CDFG stream alteration permits, CWA 401, 402, and 404 permits, for example, if construction activities affect aquatic environments. Opposition to revegetation by those who view it as negatively affecting flood flows could delay the permitting process. There is a possibility to provide advance mitigation credits thereby streamlining the permitting process. Could result in delisting or preventing additional listings resulting in reduced permitting issues for all projects over time.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Habitat improvement projects can provide mitigation opportunities for habitat losses elsewhere in the flood management system. If coupled with long-term agreement for operations and maintenance, revegetation can stabilize banks and reduce downstream sediment yield, reducing the need for dredging operations.

Additional transitory storage and seasonal habitat creation would benefit fish and wildlife species and likely reduce maintenance requirements by relieving pressure on surrounding levees during flood events. May reduce permitting conflicts over the long-term.

Social Considerations

Contribution to Public Safety?

Potential increase. if combined with a management action such as setback levees, native habitat has the natural capacity to attenuate floods and therefore the potential to improve public safety by attenuating flood peaks and reducing the frequency of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Yes. Potential to enhance aesthetic, recreation and open space values (e.g., trails, hunting, and/or wildlife viewing). Potential to contribute to groundwater recharge and potential for water supply benefits through creation and enhancement of wetlands (detention of flood water and natural contaminant filtering). Increasing active flood plains and associated wetlands could result in benefits to water quality due to temporarily storing floodwaters, filtering nutrients and impurities from runoff, processing organic wastes, capturing high sediment loads outside of the main flood channel, and moderating water temperature fluctuations.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically and institutionally acceptable, especially in areas that wouldn’t require extensive modification to the flood management system. Potential implementation challenges related to changes in existing and potential future land uses, land acquisition, responsibilities for long-term maintenance of restored habitat. Additionally, habitat creation projects have to compete for scarce financial resources, so implementation may be slow due to tight budgets.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No major change likely. As habitat enhancements would be constrained by the requirement to not compromise design flows, there would likely be no major change in upstream hydraulic impacts. Potential increase in large woody debris in channel downstream if timely and appropriate maintenance is not performed. Depending on the location wetland creation or floodplain reconnection could put additional strain on infrastructure not originally designed to withstand seasonal flooding (e.g., bridges, buried pipelines, electrical transmission towers, cell towers).

Effect on Residual Risk?

No major change likely. As habitat enhancements would be constrained by the requirement to not compromise design flows, there would likely be no major change in residual risk. There is a possibility that implementation may reduce residual risk downstream by attenuating flood peaks. Potential increase in large woody debris in channel downstream if timely and appropriate maintenance is not performed. Long term maintenance standards and funding should be established as much as possible at the time of project implementation to avoid issues with future maintenance.

Climate Change Adaptability

This action would increase biological adaptability by increasing the amount and connectivity of and range of environmental conditions within native habitats, and thus, may increase the ability of these habitats and the species that reside in them to adjust to climate change, and to persist through and recover from extreme events. In addition, wetland creation could ameliorate peak runoff events. An increase in vegetation will help offset climate change by removing carbon dioxide from the atmosphere.

6.0 Floodplain Management

MA-025: Reduce flood damages through acquisitions, easements, and private conservation programs

MA-026: Manage municipal stormwater to provide regional or systemwide flood benefits

MA-028: Coordinate and streamline floodplain mapping to improve consistency of floodplain delineation and assessment of flood risk

MA-074: Increase flood risk awareness through outreach and education

MA-075: Provide technical procedural assistance to local agencies for flood mitigation compliance and grant application assistance

MA-076: Assist in development of local flood management plan updates and provide procedural and technical support for implementation

MA-077: Facilitate increased awareness of and participation in the Community Rating System insurance-rate adjusting program

MA-078: Develop mandatory flood insurance programs that are more consistent with the area's risk of flooding

MA-079: Increase public understanding of FEMA maps and policies

MA-080: Develop a State program and framework to reduce or eliminate subsidies for repetitive loss properties in flood-prone areas

MA-090: Construct training levees or levees that subdivide larger basins

MA-095: Use floodproofing measures

MA-097: Improve awareness of floodplain function through outreach and education

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Reduce flood damages through acquisitions, easements, and private conservation programs

ID MA-025

Description

Problem

Much of the flood system has isolated floodplains from river and stream channels. Natural floodplains have been reduced due to limited understanding of their benefits, including their natural capacity for flood storage and conveyance. This has led to constrictions to flow that create flood hazards, present maintenance problems, and to loss of ecosystem quality and function. The constricted flow paths require that reservoirs hold flood flows and restrict and/or meter flows more often to control peak flows to prevent flooding of adjacent lands.

Desired Outcome

Reduced flood damages, improved river processes, enhanced ecosystem value, and improved water supply management.

Methodology

Lands adjacent to channels that currently or historically were flooded during periods of high flow would be inundated more frequently, at greater depths, or for longer periods of time, primarily during winter and spring. This would be achieved by reconnecting historical floodplains to channels using setback levees or by increasing the frequency with which existing connected floodplains are inundated by water that tops the bank, controlled levee breeches, weirs, or other gated mechanisms. However, advantages of increasing floodplains must be balanced against the impact to existing land uses and critical infrastructure in floodplains. Acquisition of some property, whether land or structures, would occur as necessary to ensure the effectiveness of the flood management system. Plans would be developed to adequately replace lost property, revenue, and uses of acquired lands and services. Relocating structures would be considered in high-hazard areas where human occupancy is unsafe (e.g., where flooding occurs frequently and/or very rapidly) and where onsite flood-proofing measures are inadequate (e.g., in areas where floodwaters are extremely deep). The use of voluntary flood easements would be explored to accommodate flood waters, preserve agricultural land, and provide habitat. In addition, private land conservation programs could be expanded through developing partnerships and incentive programs.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Promote Ecosystem Functions
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation.

Advantages

- Reduces both flood and residual risk.
- Reduces long-term emergency response and flood fighting costs.
- Increases public safety.
- Provides water supply improvement and ecosystem improvement.

Disadvantages

- Potentially high capital cost.
- Potential terrestrial environmental impacts in floodplain inundation area.
- Potential public resistance due to high costs and relocations.
- Potential reduction in tax revenue.

Economic Considerations

Capital Cost? (High, Medium, Low)

Potentially high initial investment depending on location and extent of floodplain acquisition (costs include real estate acquisitions, relocations, mitigation costs, and levee construction, engineering, and permitting costs). Long-term disaster cost avoidance may offset the initial capital costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Could increase costs for floodplain and floodgate maintenance.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes. Also potential for State and local cost sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease long-term costs for emergency response and recovery through reduction in the frequency or magnitude of flooding outside the floodway and relocation of people and property. Could decrease emergency costs associated with levee repairs and failures because depth and velocity on levees would be diminished.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease the long-term cost of flood fighting due to decreased floodwaters and decreased populations in the floodplain.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical infrastructure due to lower velocity and reduced flood stage.

Effect on Floodplain and Economic Development?

Floodplain development could be discouraged in order to maintain the natural processes of the floodplain. This may lead to decreased tax revenue. Potential to improve water-supply reliability, which could support economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility through reduction in the frequency or magnitude of flooding and relocation of people and property.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could rehabilitate key physical processes (e.g., sediment transport balance and meander migration) and ecosystem functions by enhancing groundwater recharge, floodplain and channel forming processes, and water quality. Could enhance floodplain spawning habitat and salmonid rearing habitat, and rehabilitate floodplain riparian and wetland habitat.

Potential for Adverse Environmental Impacts?

Moderate to substantial permanent impacts to terrestrial, agricultural, and potentially to seasonal or freshwater marsh wetland habitats, including potential loss of habitat for special-status species. Entrainment issues may also occur. The floodplain needs to operate properly or benefits for fish will be hindered. Hazardous materials (from gas stations, chemical plants, etc.) have the potential to be mobilized in the new floodplains.

Permitting Considerations?

Permitting considerations are likely to be minor.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Habitats that have been affected by flood system O&M would be rehabilitated.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of flooding and relocation of people and property.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to create open space, recreation areas (trails, hunting, wildlife viewing), and natural habitats. Water supply may increase as groundwater recharge is enhanced within the expanded floodplain.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Implementation is highly variable depending on the location and geographical extent of land acquisition. However, floodplain acquisition in smaller specific areas may be more feasible. Likelihood of implementation could increase if local communities are educated on the benefits of floodplains and contribute to land acquisition process (e.g., non-fee acquisitions and dedications There will also be a need to find willing landowners to sell their land and participate in implementation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential reduction in downstream peak flows.

Effect on Residual Risk?

Reduces the magnitude of flooding, and relocates people and property out of floodplains, thereby reducing residual risk.

Climate Change Adaptability

This action would enhance hydrologic adaptability by increasing water management flexibility. Reservoir capacity previously dedicated to controlling flood flows could instead be dedicated to water supply. Biological adaptability could be enhanced by improving habitat connectivity and increasing habitat quantity to sustain population viability.

Manage municipal stormwater to provide regional or systemwide flood benefits

ID MA-026

Description

Problem

Municipal storm flows exhibit accelerated runoff and higher peak flows than an undisturbed landscape. These characteristics create more scour, higher stages, more dangerous channel velocities, and generally more destructive flows, and they occur over a shorter period of time than flows from an undisturbed watershed. Both locally in individual catchments, and collectively across regions or basins, this shift in runoff can increase the risk of flood damage to property and the ecosystem.

Desired Outcome

Improved flood management and ecosystem functions through improved municipal stormwater management.

Methodology

Stormwater management is governed and implemented by municipalities and other local agencies. There are opportunities to coordinate local stormwater management with regional flood operations and to explore the treatment and reuse of stormwater. There is a need to assess runoff and the hydrology of basins, compare the anticipated volumes, timing, and velocities with channel capacities, and develop a landscape that accommodates the expected flows in a manner that minimizes the risk to communities and ecosystems. Examples of implementation include replacement of concrete/pavement or other hardscape surfaces with vegetative surfaces to reduce runoff and increase infiltration; use of diversion channels to collect excess surface water and convey it to a waterway or detention basin for infiltration; use of vegetated waterways to reduce erosion, improve water quality, support riparian habitat, and improve aquatic species migration and breeding; use of ~~terracing~~ meanders and other methods to reduce the volume and velocity of runoff from sloped land; diverting floodwaters from recharge facilities to in-stream flows to improve water supply and quality.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained. Requires further evaluation.

Advantages

- Potential to provide multiple benefits (e.g., recharge, water quality, habitat, local flood improvements, economic, cultural, social, aesthetic) with local, regional and statewide implications.
- Onsite detention or retention of increased peak runoff, reduces the possibility that development will add to the flood peak.

Disadvantages

- Potential for systemwide benefits is uncertain.
- Moderate to high costs if implemented on large scale.
- Under jurisdiction of local municipalities; large-scale implementation may require new policies or incentives at regional or State levels.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low-to-medium capital costs to implement on large scale, depending on methods employed.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Potential cost-sharing with local and State sources.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce emergency response and recovery costs through reduction in the frequency or magnitude of local flooding, primarily in urban areas and small communities.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to reduce flood fighting costs through reduction in the frequency or magnitude of local flooding, primarily in urban areas and small communities.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in frequency or magnitude of local flooding, primarily in urban areas and small communities.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Could impact permitting processes and decisions.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through reduction in the frequency or magnitude of localized flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential for improvement of water quality, aquatic species migration and breeding, and water supply; may also support restoration of certain habitat types. Recreation, property value, and open space benefits may benefit local economies.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Stormwater management falls under local, municipal, and State jurisdictions; large-scale implementation (to provide systemwide flood benefits) would require coordination by a large number of municipalities and local and State agencies, which would likely require changes to stormwater policies at a regional (local jurisdictions or integrated water organizations), State (Water Boards), and federal (USEPA) level.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Stormwater programs will potentially reduce adverse hydraulic impacts downstream.

Effect on Residual Risk?

None.

Climate Change Adaptability

Coordinating stormwater management with flood operations has potential to enhance hydrologic adaptability at a local level; hydrologic alterations could enhance biological adaptability by reducing the adverse consequences of peak flows for habitats, and possibly by increasing the quantity and connectivity or continuity of habitat along environmental gradients.

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Coordinate and streamline floodplain mapping to improve consistency of floodplain delineation and assessment of flood risk

ID MA-028

Description

Problem

Floodplain boundaries provided by USACE, FEMA, and DWR are often different from each other due to variation in the available data and intended purpose of the map. Inconsistencies between the floodplain boundaries of multiple agencies can cause public confusion regarding flood risk. Good floodplain mapping and related flood hazard data serve a crucial role in identifying properties prone to high flood risk. Local communities, State government, and the private sector require accurate, detailed maps to guide development, prepare plans for community economic growth and infrastructure, utilize the natural and beneficial function of floodplains, and protect private and public investments.

Desired Outcome

Improved accuracy and understanding of current and new floodplain maps for appropriate flood planning, maintenance, and emergency response. Increased awareness of the different types of maps and their appropriate uses.

Methodology

DWR would coordinate with other hazard mapping efforts to create, develop, produce, and disseminate geographic information system (GIS)-based multi-hazard advisory maps and distribute them to local governments and the public. Such maps would facilitate pre-planning response options to foreseeable breach scenarios, or typical levee problem scenarios, which would expedite response at the time of the flood. This effort would involve the development of a comprehensive, unified floodplain-mapping program that would clarify current floodplain mapping boundary applications. The program would develop a unified set of floodplain-mapping standards for the foundational data sets used for topography, hydrology, hydraulics, and floodplain delineations to ensure consistent floodplain delineation and assessment of flood frequency and risk. However, in recognition of the fact that specific maps are needed for different purposes (e.g., risk notification and insurance rates), the program should describe the different types of floodplain maps and their appropriate uses.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Increases flood preparedness and awareness.
- Low cost to implement.
- Discourages floodplain development.
- Consistent floodplain information will be available from all agencies.

Disadvantages

- Requires multi-agency cooperation.
- There is often resistance to floodplain mapping that shows the potential for floods and the depth of those floods because it is often considered to be detrimental to community self-esteem, development, and property values.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-high capital cost to implement. Requires consensus on standards and database population. Includes cost of infrastructure to house and maintain these databases. The land must be surveyed in a fairly detailed manner to get the resolution needed for levee break scenarios.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Small increase; database will need regular updates.

Potential for Cost-Sharing?

Potential for cost-sharing as part of multi-agency coordination.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease emergency response and recovery costs, due to increased flood preparedness and awareness.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change to flood fighting costs.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure, due to increased flood preparedness and awareness.

Effect on Floodplain and Economic Development?

Floodplain development may be discouraged with increased awareness about what areas are particularly susceptible to increased flooding due to development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility through increased flood preparedness and awareness.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Potential to influence land use decisions could lead to floodplain creation or restoration.

Potential for Adverse Environmental Impacts?

Possible indirect environmental impacts.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through increased flood preparedness and awareness.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potential to discourage activities that complicate flood management, such as development in floodplains.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Feasible and likely implementable.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential to prevent increases in downstream flow if development is discouraged.

Effect on Residual Risk?

Potential to prevent increases in residual risk if development is discouraged.

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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Increase flood risk awareness through outreach and education

ID MA-074

Description

Problem

Among the public there is a general lack of understanding of flood risk because of limited access to information, a false sense of security, and an undefined responsibility for education. Many property owners assume that if they are outside of the 100-year floodplain they are safe. Some also wrongfully assume that 100-year-certified levees will protect them against any level of flooding. As a result of this lack of understanding, participation in voluntary flood insurance programs is low. State, federal, and local flood control agencies have struggled to educate the public with a comprehensive and consistent message on flood management. Governments and flood control managers are generally more adept at flood systems O&M than communicating the needs and challenges of flood management to the public.

Desired Outcome

Improved public awareness of flood risk and actions to reduce or mitigate risk, with resulting increased participation in voluntary flood insurance.

Methodology

DWR could expand outreach programs to include public service announcements or workshops that increase public awareness of floodplain values, flooding hazards, public safety, and hazard mitigation measures. State or local agencies could notify property owners of the flood risks associated with living behind a flood protection structure or develop an interactive Web site that would allow users to access detailed flood hazard maps.

There are opportunities for outreach activities using already established media outlets, such as newspapers, news broadcasts, social media. Students from K-12 could be educated about flood risks as a mandatory part of their curriculum, including the flood protection system, flood risks, levees, and even elementary planning concepts. There are also opportunities for coordination and sharing knowledge between State and local flood managers and for encouraging flood managers to obtain the Certified Floodplain Manager certification. Sharing knowledge can improve political support for funding, construction, new legislation, and emergency preparedness and response. This information should be presented in a way that wouldn't result in public panic and could increase participation in voluntary flood insurance. Outreach should also aim to increase tribal groups' awareness of the risk of flooding and notify the tribes about the available assistance programs.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Potential to reduce flood damage, reduce floodplain development, and increase public safety.
- Well-informed public is more likely to support land use decisions consistent with floodplain function.
- Relatively low cost.

Disadvantages:

- Does not directly reduce flood risk.
- Local agencies may have trouble with funding.
- Flood information will not be consistent without region-wide coordination.
- Costs of implementing a new education program may be a burden to some schools.
- Informing property owners that they are prone to flooding when the actually are not (such as Levee Flood Protection Zones), undermines the integrity of the notification process.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Policy and Outreach MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction. Example of capital investments include: Funding for training, education, and promoting awareness of flood risk among the public and those responsible for implementing floodplain management decisions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate increase in costs depending on how often flood information is disseminated. Resources will need to be provided periodically for the State to conduct Community Assistance Visits (CAVs) and to reinstitute Community Assistance Contacts (CACs). Annual funding will also be required for other types of public education and outreach activities.

Potential for Cost-Sharing?

High potential for cost-sharing with local, State, and federal agencies to increase public awareness of floodplain values, flooding hazards, and public safety. Consequently, if the public and politicians see the value of emergency preparedness, then they will be more likely to support future flood management efforts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease emergency response and recovery costs. Better characterization of flood risk in communities could compel communities to flood-proof their infrastructure (both in new construction and by retrofitting existing structures) which would reduce potential damage and need for recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change. This management action contributes to increasing public awareness of flood risk, not to flood fighting coordination.

Effect on Damage to Critical Infrastructure?

No change. This management action contributes to increasing public awareness of flood risk, not reducing flood risk.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease long-term State flood responsibility by increasing public awareness.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

This management action improves public safety by reducing the consequences of flooding. Improving and promoting flood education and awareness programs in communities could discourage communities from developing in floodplains. Often, the general public and politicians are not aware of the dangers of flooding, until an actual emergency occurs.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood of implementation, required by AB156 (Laird), implementing Water Code Section 9121.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No redirected hydraulic impacts.

Effect on Residual Risk?

Increasing public awareness has the potential to reduce the consequences of flooding, therefore reducing the residual risk.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

Provide technical procedural assistance to local agencies for flood mitigation compliance and grant application assistance

ID MA-075

Description

Problem

Many local agencies need assistance in pursuing State and federal grants to mitigate flood risk. Many State and federal agencies have funding sources to assist local jurisdictions with their flood risk issues. Within these agencies, there are multiple programs that locals may not be completely familiar with. Local project opportunities are sometimes not planned or implemented because of lack of knowledge about the available grant programs. Providing a clear roadmap for local agencies and assisting them through the process of identifying the best programs for their needs is a service that is not readily available at this time.

Desired Outcome

Increased local jurisdiction participation and awareness of various State and federal programs. Increased participation in and awareness of FEMA's Flood Mitigation Assistance (FMA) Program, FEMA's Pre-Disaster Mitigation (PDM) grant program, and FEMA's Hazard Mitigation Grant Program (HMGP). Stronger partnerships and participation with all levels of government to maximize resources in support of State and federal programs.

Methodology

Provide assistance to local agencies and practitioners to notify them of the availability of FMA, PDM, and HMGP grants and other federal and State grant programs. FEMA’s FMA Program was created with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA planning, project, and technical assistance grants to assist states and communities implement measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. In Fiscal Year 2009, $35,700,000 of funding was available for the FMA programs. California received $842,400 compared to the highest grant award of $5,193,300. Since CalEMA oversees the program, DWR could enhance its partnership with CalEMA staff to publicize availability of the grants and disseminate grant information, when applicable, to its local partners. In addition, DWR could work with CalEMA and FEMA to develop a standard presentation or workshop and related materials to help local communities complete HMGP or PDM grant applications and provide benefit/cost information. DWR could designate a group or person to serve as a primary point of contact and resource for local communities for preparing grant packages and coordinating with CalEMA.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Providing assistance to localities for federal grant (and other State grant, e.g., LLAP, FCP, YFFPP, etc.) applications can, if the grants are won, improve flood protection statewide on various levels while reducing the financial responsibility of the State.

Disadvantages

- None.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial cost of additional staff to accomplish this management action. Outreach management actions tend to have a substantially lower capital cost than other management actions which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to decrease O&M costs; FMA grants are used to support programs that reduce long-term risk for flood damages. Improvements to the flood control system may decrease O&M costs. May require initial cost outlay for more staff.

Potential for Cost-Sharing?

Cost sharing is central to this management action; State provides assistance to localities applying for federal grant money. Definite cost sharing opportunities at the local, State and federal levels.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease emergency response and recovery costs. Increased technical assistance could improve compliance, floodplain management, land use decision making and ability to fund worthwhile projects. FMA grants are used to support programs that reduce long-term risk for flood damages (e.g., reducing frequency and/or consequences of flooding).

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to decrease flood fighting costs; FMA grants are used to support programs that reduce long-term risk for flood damages (e.g., reducing frequency and/or consequences of flooding).

Effect on Damage to Critical Infrastructure?

Potential to reduce risk to critical infrastructure; FMA grants (or other State and federal grants) may be used develop protection measures for critical infrastructure elements.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease long-term State flood responsibility if FMA grants (or other State and federal grants) are used to improve the flood control system.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety if FMA grants (or other State and federal grants) are won and used to improve flood control and prevention projects intended to improve public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood of implementation; minimal costs for the State to assist localities in grant applications with large potential benefits.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability:

This action is unrelated to hydrologic and biological adaptability.

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Assist in development of local flood management plan updates and provide procedural and technical support for implementation

ID MA-076

Description

Problem

Legislation signed in 2007 included new requirements for providing flood protection to urban and urbanizing areas in the Central Valley. The flood legislation establishes protection from a 200-year flood event (flood with a 1-in-200 chance of occurring in any year) as the minimum level of flood protection to be provided in urban and urbanizing areas by 2025. The Legislature sets deadlines for cities and counties in the Central Valley to amend their general plans and zoning ordinances to conform to the CVFPP within 24 months and 36 months, respectively, of its adoption by the Board. Once the general plan and zoning ordinance amendments are enacted, the approval of development agreements and subdivision maps is subject to restrictions in flood hazard zones. Some local agencies are limited in their capacity to comply with new requirements and may require institutional and technical support from the State.

Desired Outcome

Integrated planning and implementation methods for local entities to ensure compliance with the 2012 CVFPP, including general plan updates, local flood management plan updates, regional general permitting, Natural Community Conservation Plan (NCCPs), and habitat conservation plans (HCPs).

Methodology

Within 24 months of adoption of the CVFPP, the State would adopt and integrate standards for use by local governments to ensure they are in compliance with applicable provisions of the CVFPP during general plan and other planning document updates, such as specific terminology and criteria, e.g., what is a 200-year flood event. Within 36 months of CVFPP adoption, the State would adopt and integrate standards for use by local governments to ensure they are in compliance with applicable provisions of the CVFPP when local zoning amendments are enacted. Implementation could be based on California Office of Emergency Services (OES) or Council of Governments COG models. The "Implementing California Flood Legislation into Local Land Use Planning: A Handbook for Local Communities" could be used as a guide to incorporate flood risks into local flood risk planning and general plans. Training workshops on the use of the handbook could be conducted and technical assistance could be provided if resources are available.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces flood risk.
- Discourages floodplain development.
- Establish consistency in planning policy.

Disadvantages

- Some local agencies may require significant institutional and technical support, especially during the plan update process.
- Requires large coordination efforts.
- 200-year flood protection may be unattainable for some areas, either for financial reasons, or site limitations, or possible environmental restrictions.

Economic Considerations

Capital Cost? (High, Medium, Low)

No capital costs for standards development and plan amendments.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to O&M costs for updating plans; secondary costs associated with new flood infrastructure could increase.

Potential for Cost-Sharing?

Potential for federal cost sharing via contributions to existing federal project purposes (flood management). Also potential for local cost sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Likely to reduce long-term costs for emergency response and recovery through reduction in flood risk.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Could decrease urgency and extent of flood fighting by limiting areas of highest potential losses, allowing some areas that would otherwise be a priority for flood fighting to be given low or no priority.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical public infrastructure through reduction in flood risk.

Effect on Floodplain and Economic Development?

Potential reduction in floodplain development in high-risk areas due to changes in zoning ordinances.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility through reduction in flood risk.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Advanced mitigation planning and development of general permits could contribute to rehabilitation ecosystem functions by mitigating in advance of impacts, mitigating in large consolidated areas, and identifying the most suitable areas for habitat rehabilitation.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Plan updates may trigger the programmatic CEQA process for local agencies, and the plans will impact future permitting processes in the Central Valley.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase safety through reduced flood risk.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Regulations and planning requirements have the potential to benefit water supply, water quality, ecosystem enhancement, recreation, and agricultural industry.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Implementation required by legislation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Measures associated with new planning requirements could shift flood flows onto downstream areas.

Effect on Residual Risk?

Potential to prevent increases in residual risk due to changes in zoning ordinances.

Climate Change Adaptability

This action could enhance biological adaptability by increasing the ability of conservation actions to increase habitat extent, connectivity, complexity, and continuity across environmental gradients; and thus, enhance the ability of populations to handle and adjust to the consequences of climate change.

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Facilitate increased awareness of and participation in the Community Rating System insurance-rate adjusting program

ID MA-077

Description

Problem

The Community Rating System (CRS) was created to encourage and recognize communities that engage in floodplain management activities that exceed minimum NFIP standards. Despite the reduction in flood insurance premiums offered to participating communities, only 14 percent of California communities (accounts for 55 percent of the NFIP policy base statewide) are participating in the CRS program. Communities lack staff and time to apply and maintain program requirements.

Desired Outcome

Increased participation and existing CRS classifications in the CRS program.

Methodology

DWR’s CRS Program Coordinator would create a strategic plan with a national CRS expert. DWR would also discuss customization of CRS programs with FEMA to address more area-specific issues in the Central Valley. A CRS Users Group could be developed to encourage California CRS communities to exchange information and assist non-CRS communities in applying for the CRS program. Current State activities that are part of FloodSAFE may be eligible for CRS points.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Encourages local communities to participate in the CRS program while their residents receive a reduction in NFIP insurance premiums.
- Residents also benefit from improved public safety and greater property protection.

Disadvantages

- Initial coordination could be cumbersome and time consuming, but should not be problematic long term.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Costs associated with this action would be associated with CRS coordination at the State level and outreach and training costs to educate the public and local agencies about the advantages of participating in the CRS program.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Minor increase in cost.

Potential for Cost-Sharing?

Potential for cost-sharing with local agencies that work with or receive assistance from the CRS coordinator's office. Should also coordinate with FEMA.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Encouraging more local entities to participate in the CRS program will decrease long-term flooding costs because the CRS communities will have better floodplain management programs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Improves overall decisions on building new structures, including critical facilities.

Effect on Floodplain and Economic Development?

Potential reduction in floodplain development in high-risk areas due to changes in local building restrictions.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decrease. Requires stricter floodplain management, thereby decreasing flood risk losses and increasing public safety.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could improve key physical and ecological functions through stricter requirements.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Improves permitting process through stricter building requirements.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

CRS encourages better floodplain management, land use decisions, education and outreach within the community with the intent of increasing public safety. Participating in CRS by default increases the protection provided to communities because their flood protection will exceed what is necessary by NFIP standards.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

CRS communities in general, incorporate open space preservation, retention basin, parks and rec. decisions into their floodplain management.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be easy to implement. There are other State or local programs where coordination regarding education and outreach already occur and these could be used as a model. High support exists at the local, State and federal levels for the CRS program.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

CRS participation would reduce residual risk for participating communities because they would have increased flood protection.

Climate Change Adaptability

Floodplain management considers the effects of climate change.

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Develop mandatory flood insurance programs that are more consistent with the area's risk of flooding

ID MA-078

Description

Problem

Under the current rules of the NFIP, homes protected by levees certified by the USACE as providing 1-percent chance event flood protection are not required to obtain flood insurance. For insurance purposes, these structures are considered to be outside the 1-percent chance event floodplain. However, floodplain occupants situated behind levees are still exposed to a residual risk from flooding due to unforeseen factors such as poor construction, poor maintenance, undetected rodent activity, undetected geotechnical problems, or seismic events. Furthermore, while levees reduce the occurrence of flooding, they do not protect against the consequences of more severe floods. For example, a home built behind a levee designed to provide 100-year flood protection is at greater risk than a home built to the 100-year flood elevation. The home behind the levee could become completely inundated from a flood that exceeds 100-year levels.

Desired Outcome

A State-sponsored insurance program so that those subject to residual flood risk are protected by flood insurance and property owners in all flood zones carry flood insurance.

Methodology

Create a flood hazard zone for areas behind credited levees, where federal flood insurance would be mandatory and new buildings sited within the zone would pay actuarial-based insurance rates. Encourage FEMA to establish a mandated flood insurance program for homes behind levees with preferred risk options and for structures protected from less than the 0.5-percent chance event floodplain. Graduate federal flood insurance premiums according to a structure's level of flood risk rather than the structure's location (based on a combination of frequency and actual damages). Additional information besides Flood Insurance Rate Maps (FIRM) should be used for decision making. All public agencies not subject to local government floodplain management requirements or the Governor's Executive Order on Floodplain Management should comply with NFIP requirements. The State should consider developing a proposal to FEMA that would allow some relief from its policies, perhaps in the State Plan of Flood Control Planning Area (SPFCPA), in return for certain State assurances. This requires close coordination at federal, State, and local levels. Partnership with the Department of Insurance is needed. Partnership with the USACE's Silver Jackets program and increased partnership with Floodplain Management Association will assist providing information and educational workshops to local communities and the public.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- If floodplain maps are used to make better building location choices, this management action would reduce loss to property.
- Insurance is a more realistic and predictable way to deal with flood recovery than relying on State of federal assistance after the event.
- Provides a more realistic assessment of flood risk and increases public risk awareness.

Disadvantages

- Coordination between federal, State and local agencies can be problematic.
- Could also increase costs for some people in "new" areas of flood risk.
- There will be some public resistance to a mandatory program, especially by those in established neighborhoods that have not had to purchase flood insurance in the past.
- Frequency and damage data is not available for many communities.
- Risk assessment for properties in flood plains is expensive and time consuming.

Economic Considerations

Capital Cost? (High, Medium, Low)

Variable, depending on the geographical extent of areas requiring flood insurance based on new flood risk zones.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Potential for cost-sharing in areas that receive protection from SPFC facilities..

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Recovery costs would be decreased because flood risk would be reevaluated based on protection provided for structures and not their physical location.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Depends on how many critical facilities are currently benefiting from some level of protection from levees.

Effect on Floodplain and Economic Development?

This could discourage floodplain if insurance rates are changed to better reflect a structures flood risk. Would encourage better building standards behind levees and possibly limit construction in these areas depending on building regulations and insurance requirements.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to increase or decrease State flood responsibility if areas protected by the SPFC are amended due to changes in the way flood risk is evaluated. Dependent upon final regulations - needs further evaluation.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could affect physical and ecological functions.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Permitting decisions would be impacted in areas behind levees.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Could contribute to reduction of loss and quicker post-flood recovery.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Potentially could impact decisions concerning open space, parks and rec. etc.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This could be difficult to implement. FEMA and the State would need to cooperate and possible change the way flood risk is determined and the rates that should be paid for protection. This could also cause some people who were not previously considered in a flood risk area to now be required to buy flood insurance. Politically sensitive subject requiring high level coordination of federal, State and local level. Similar proposal proposed at federal level.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

This should reduce residual risk by protecting homes at risk for flooding based on protection provided and not just their geographic location.

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

Increase public understanding of FEMA maps and policies

ID MA-079

Description

Problem

Floodplain maps are often the main resources used by the public and decision makers to understand flood risks. Floodplain boundaries often change, pushing properties once thought to be outside a flood hazard area inside a special flood hazard area. Shifting properties in and out of floodplains sends conflicting messages to the public about flood risk and can undermine the credibility of floodplain maps in the eyes of the public. While the public's lack of flood awareness can be partially attributed to constantly evolving and confusing floodplain maps, the public also bears responsibility for underestimating the risks of flooding.

Desired Outcome

Improved public flood risk education regarding FEMA responsibilities and policies, how FEMA regulations affect private property, and how these policies relate to State programs.

Methodology

Establish a collaborative, multi-agency technical committee to educate and engage the public and governmental agencies on achieving tolerable levels of flood risk. Work with FEMA/NFIP and other State and local agencies and governments on outreach, education, and awareness programs. Partnership with the USACE's Silver Jackets program and increased partnership with the Floodplain Management Association will assist providing information and educational workshops to local communities and the public.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Improved flood risk understanding would go a long way to create goodwill and increase cooperation with FEMA and the State by landowners.
- Many property owners are already being notified through the LFPZ program Water Code Section 9121.

Disadvantages

- There will be costs associated with public outreach and education.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. The primary costs with this action would be outreach and education activities, to educate people about their flood risk and how FEMA maps are developed and used to assess their risk.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Minor increase.

Potential for Cost-Sharing?

Potential for cost share among agencies for outreach activities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Better education may contribute to decreased cost for emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Education on flood risk and justification for location of critical infrastructure could help alleviate economic impacts.

Effect on Floodplain and Economic Development?

Better education improves decision making (e.g., building in the floodplain and economic impacts).

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Improved understanding of flood risk provides support for stronger floodplain management lessening damages and potentially the State's liability.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Could improve key physical and ecological functions.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

May positively impact the permitting process in communities.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

A better educated public can take action to improve their own safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved education provides a foundation for property owners participating on committees to make land use decisions.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be easy to implement because it would primarily involve education and outreach activities.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Lowers potential of residual flood risk through education, outreach and awareness programs targeted at property owners.

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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Develop a State program and framework to reduce or eliminate subsidies for repetitive loss properties in flood-prone areas

ID MA-080

Description

Problem

There are instances where owners of property within the floodplain have accumulated insurance claim reimbursements equal to or greater than the value of the structure for repeated flood damages.

Desired Outcome

Reduced flood insurance liability loss of lives and property, and tax burden to State and federal taxpayers.

Methodology

Develop a California-specific program (independent of FEMA) to identify and eliminate subsidies for structures that are repetitively damaged. Work with FEMA to terminate federal flood insurance for property owners who have accumulated claim reimbursements equal to or greater than the value of the structure or require reimbursements to be used toward flood mitigation measures such as relocating, elevating structures, flood proofing, or demolition if the structure is repetitively or substantially damaged. This will require coordination with FEMA/NFIP and local communities to implement. Research and publicize the availability of FEMA grants that target the removal or elevation of "Repetitive Loss" structures, specifically the Severe Repetitive Loss, Flood Mitigation Assistance grants, and Repetitive Flood Claims Program. Provide training and on-line presentations on how to complete these grants that are specific to repetitive loss.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Overall improved protection of lives and property over the long term.
- Money not spent on repetitively damaged structures can go to other programs and assistance.

Disadvantages

- Not politically or publicly popular.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low/medium. This management action would save money by reducing the amount that can be paid for repetitively damaged structures by the NFIP but may require some funds for mitigation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. Initial annual cost would be greater in first few years until program was fully phased in and benefits realized.

Potential for Cost-Sharing?

Federal, State and local cost sharing opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. By limiting repetitive reimbursement for damages or forcing the use of repetitively damaged property reimbursements for relocation, etc. recovery costs will be reduced.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Presumably few critical facilities are qualifying repetitive loss structures.

Effect on Floodplain and Economic Development?

This could affect floodplain development by reducing the construction of structures that could be repetitively damaged due to flood risk.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decreases State flood responsibility by decreasing number of repetitive loss structures.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Definite improvement to public safety. Improves permitting process through stricter building requirements and floodplain management standards.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

There may be resistance to this action because many payees will resist moving their structure or the redirection of insurance payments to other flood management activities. This will require a major policy change to enact. This has already been proposed at the federal level and is met with significant political challenges.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

This should reduce residual risk by providing incentives to relocate structures out of areas of repeated inundation or high risk.

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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Construct training levees or levees that subdivide larger basins

ID MA-090

Description

Problem

Some flood control systems within the study area protect large, expansive basins from deep flooding (up to 20 feet in depth). While extensive planning and design considerations are incorporated into flood control systems, flood control is based on statistical evaluations. If a small portion of a levee fails within a system that protects a large and heavily populated basin, the entire basin could be inundated. Subdividing levees could limit the inundation following the failure of a primary flood control system. Training levees could redirect the erosive forces of flood waters to reduce the likelihood of levee failure.

Desired Outcome

Isolated failure of a flood control system does not inundate the entire basin (or lands) that it protects.

Methodology

Analyze existing flood control systems to determine areas susceptible to erosive force and failure, and construct a training levee to reduce the risk of failure. In areas where flood control systems protect basins, perform analyses to determine the best location for subdividing the levee to minimize the risk of primary levee failure.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Construction of training levees could reduce the risk of primary flood control system failure, and reduce O&M costs.
- Construction of subdividing levees could substantially reduce the impact of primary levee failure.

Disadvantages

- While training levees have merit in erosion mitigation, construction of sub-dividing levees will be redundant to a primary flood control system and may not be eligible for federal funding.

Construction of training levees or sub-dividing levees could significantly impact existing riverine/riparian habitat.Economic Considerations

Capital Cost? (High, Medium, Low)

Medium to high. Training levees may be relatively short to be effective. Subdividing levees may be very long, and be a significant cost of any flood control system.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. Both training levees and sub-dividing levees will require regular maintenance, and likely significant repair and rehabilitation following flood events.

Potential for Cost-Sharing?

Low. Subdividing levees would be redundant to primary flood control facilities, and have a high capital cost. It is unlikely there would be a federal interest.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Could decrease emergency response and recovery costs by reducing extent of inundation and resulting emergency response activities.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Increase. There may be an increase in flood fighting efforts at training levees and subdividing levees.

Effect on Damage to Critical Infrastructure?

Potential to reduce damage to critical infrastructure by reducing extent of inundation.

Effect on Floodplain and Economic Development?

Would likely impact floodplain development due to lands being used for levees.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Addition of new levees to the flood control system would increase the State's flood control responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Construction of training levees could significantly impact existing riverine/riparian habitat. Construction of subdividing levees may impact habitat, depending on siting.

Permitting Considerations?

Extensive and complex.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

May reduce risk of flooding, will improve consequence of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Would have to be driven by State or local stakeholders.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Training levees will serve to reduce erosive forces on primary levees. Other downstream impacts are negligible.

Effect on Residual Risk?

Reduces residual risk.

Climate Change Adaptability

None.

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Use flood-proofing measures

ID MA-095

Description

Problem

Levees do not provide complete protection against flooding. Owners of structures located in floodplains may want to use flood-proofing measures (such as wet or dry flood-proofing, raising, or relocating structures). The urban level of protection required by 2007 Flood Legislation is for 200-year flood, exceeding the FEMA base flood.

Desired Outcome

Increased resiliency of buildings and reduced or eliminated damage through flood-proofing.

Methodology

There are different flood-proofing measures such as dry flood-proofing (keeping water from entering a structure), or wet flood-proofing (allowing water to enter the building with minimal interior damage). To raise a structure, utilities must be disconnected and the structure must be raised off its foundation to the new height. A new permanent foundation is then built, the house is lowered onto the new foundation, and utilities are reconnected. New stairs and landing are constructed. To relocate a structure, utilities must be disconnected and the building raised off its foundation and moved to its new location. The structure is then placed on its new foundation and utilities are reconnected.

Contributes Significantly to CVFPP Goal

- Improve Flood Risk Management

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Techniques are well known and readily available.

Disadvantages

- Cost may be prohibitive if needed for multiple structures.
- Existing structures with septic systems need additional floodproofing so flood waters do no back up into the house

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium-to-high depending on the number of structures that require floodproofing, raising, or relocation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Minor increase. Some repairs may be required after a flood event. Relocation will eliminate the need for flood-related repairs.

Potential for Cost-Sharing?

Federal, State and local cost sharing opportunities. There may be potential for FEMA grant funding for elevation projects.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Floodproofing and raising structures will reduce damages and recovery costs. Relocation will eliminate the flood damages and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No significant change.

Effect on Damage to Critical Infrastructure?

Potential to preserve the function and/or reduce damage to critical infrastructure, and enable faster recovery if structures are flood-proofed or raised. Relocating structures will preserve the function of critical infrastructure and eliminate the need for recovery.

Effect on Floodplain and Economic Development?

No direct effects; however, if the floodproofing or raising of structures results in reducing the damages of flooding, floodplain development may be encouraged. Relocating structures will discourage further development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility through reduction in damages. Relocation decreases State flood responsibility by removing structures from the floodplain.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through implementation of floodproofing and other building improvements that allow egress during a flood event. Relocation increases public safety by removing the public from the floodplain.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Relocation may allow floodplains to be restored to their natural function if no structures remain.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be easy to implement for a smaller number of structures.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Floodproofing and raising structures have no direct effect on residual risk; however, could indirectly reduce residual risks if implemented in combination with other actions to mitigate the consequences of flooding once it occurs. Relocating structures to outside the floodplain will eliminate residual risk for those structures.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

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Improve awareness of floodplain function through outreach and education

ID MA-097

Description

Problem

It is important for the general public to understand the benefits of floodplain function and why keeping floodplains functioning properly is important. Development in the floodplain impedes natural floodplain function and worries about flooding in the area is not the only issue.

Desired Outcome

For the general public to have an understanding of the importance of natural floodplain function and to make decisions on land use and development accordingly.

Methodology

DWR could expand outreach programs to include public service announcements or workshops that increase public awareness of floodplain values and its multiple uses, including ecosystem functions, agriculture, recreation. There are opportunities for outreach activities using already established media outlets, such as newspapers, news broadcasts, and social media. Students from K-12 should be educated about floodplain values as a mandatory part of their curriculum. There are also opportunities for coordination and sharing knowledge between State and local flood managers, and academia on best management practices and new science to support adaptive management. Community Assistant Visits (CAVs) and Community Assistance Contacts (CACs) can also help to determine how well communities' local floodplain management programs are functioning. This information can also be shared with the public.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Potential to reduce flood damage, reduce floodplain development, and increase public safety.

- Well-informed public is more likely to support land use decisions consistent with floodplain function.
- Relatively low cost.
- Can be coordinated with annual notification required by Water Code Section 9121 for cost sharing.

Disadvantages

- Does not directly reduce flood risk.
- Local agencies may have trouble with funding.
- Floodplain information will not be consistent without region-wide coordination.
- Costs of implementing a new education program may be a burden to some schools.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy and Outreach MAs will tend to have a substantially lower capital cost than other MAs which involve physical construction. Example of capital investments include: Funding for training, education, and promoting awareness of floodplain benefits among the public and those responsible for implementing floodplain management decisions.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Low to moderate increase in costs depending on how often floodplain information is disseminated. Resources will need to be provided periodically for the State to conduct Community Assistance Visits (CAVs) and to reinstitute Community Assistance Contacts (CACs).

Potential for Cost-Sharing?

High potential for cost-sharing with local, State, and federal agencies to increase public awareness of floodplain values. Consequently, if the public and politicians see the value of floodplains, then they will be more likely to support future flood management efforts.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

No direct effects; however, a well-informed public is more likely to support land use decisions consistent with floodplain function.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

No direct effects; however, a well-informed public is more likely to support land use decisions consistent with floodplain function.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improving and promoting flood education and awareness programs in communities could discourage communities from developing in floodplains. Often, the general public and politicians are not aware of the benefits of floodplain function and are only concerned about flooding events.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood of implementation.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No direct effects; however, if communities choose to restore natural floodplains, there may be less water in the system downstream from these communities during flood peaks.

Effect on Residual Risk?

None.

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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7.0 Disaster Preparedness and Flood Warning

MA-063: Coordinate flood response planning and clarify roles and responsibilities related to flood preparedness and emergency response

MA-064: Improve communication and public awareness of emergency response procedures and terminology

MA-065: Establish standard flood warning systems and procedures

MA-066: Improve stream gage network for forecasting purposes

MA-068: Create systemwide levee instrumentation for early warning systems

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Coordinate flood response planning and clarify roles and responsibilities related to flood preparedness and emergency response

ID MA-063

Description

Problem

Unclear roles for government agencies in supporting flood-fight operations can impede quick and effective flood fighting during a major flood event. Some agencies and organizations charged with responding in the field during a flood emergency lack the capacity, resources, and interagency coordination necessary to carry out these duties effectively. Due to the long length of time between major floods, only a limited number of emergency response staff have significant flood response experience, technical expertise, or local understanding. This is also related to limited conduction of or participation in emergency response exercises between flood events. Further, there is infrequent coordination between agencies and limited ability to advance new technologies and science related to levee breaches and flood fighting.

Desired Outcome

Improved capacity at all levels of government to coordinate actions before and during a flood to reduce the consequences of flooding.

Methodology

Implementation may include a broad range of tactics, such as promoting flood contingency and response planning at local and regional levels, and establishing a team to review current regional and local flood emergency procedures, response capacities, and communication capabilities for potential updates and improvement. In coordination with CalEMA, DWR could reconvene Maintenance System Specialist committees to review and update the 1997 Flood Emergency Action Team guidance documents and recommendations. DWR could also refine and clarify staff assignments and responsibilities related to flood fighting and emergency response, and put mechanisms in place to facilitate payment of vendors. Joint field training exercises and briefings among local maintaining agencies, DWR, and the USACE, in conjunction with CalEMA, could be facilitated to test and refine response procedures, communications, and logistics, and to educate response staff. State or federal agencies could advance awareness of rapid levee breach repair methods to facilitate repairs and speed recovery efforts.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management

- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low capital cost.
- Will reduce long-term emergency response costs due to economies of scale and increased coordination.

Disadvantages

- Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult.
- Funding for local emergency response agencies has been challenging.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low-to-medium. Policy management actions will tend to have a substantially lower capital cost than other actions that involve physical construction. Example of capital investments include funding for planning activities, communication system upgrades, joint training exercises, etc.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with maintaining agencies and local governments, State, and federal agencies for pre-flood emergency response and contingency planning.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved emergency response planning would facilitate consistent and timely response during flooding events, which could reduce potential flood damages and recovery needs. Improved communication would increase response efficiency and effectiveness.

Flood Fighting Cost? (Increase, Decrease, or No Change)

This management action contributes to effective and cost-efficient flood fighting by improving communication, technology, and training, and by leveraging regional response capabilities.

Effect on Damage to Critical Infrastructure?

Improved flood preparedness could reduce the consequences of flooding, and more successful flood fighting has the potential to reduce levee breaches and the subsequent frequency of flooding.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease. Improved flood preparedness could reduce the consequences of flooding, and more successful flood fighting has the potential to reduce levee breaches and the subsequent frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improves public safety by reducing consequences when flooding occurs. Better coordination and planning among all emergency responders ensures faster and more effective response (flood warning, evacuations, etc.).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High potential for political and public support; institutionally, support also exists, though opinions on how to implement and fund these actions likely differ. Establishing a clear and shared understanding of roles and responsibilities at all government levels may be difficult. Local agency participation may be affected by lack of funding.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk. Improving emergency response planning reduces consequences of flooding (potential damages to life and property).

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

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Improve communication and public awareness of emergency response procedures and terminology

ID MA-064

Description

Problem

While many members of the public know whether their communities are at risk for flooding, few may understand the type of flood risk they face and how they should respond in a flood emergency. The public's response to any emergency is based on an understanding of the nature of the emergency, the potential hazards, the likely response of emergency services, and knowledge of what individuals and groups should do to increase their chances of survival and recovery. Public awareness and education before a flood emergency directly affects emergency response and recovery efforts.

Desired Outcome

Increased public awareness and understanding of community flood hazards, emergency response operations, and evacuation procedures before a flood event is imminent.

Methodology

Develop and implement effective hazard communication plans that use standardized evacuation terminology. DWR could create simple, standardized flood threat levels (Flood Threat Condition 1 through 4, for example) for flood threat monitoring and management to assign appropriate flood response levels; these standardized flood threat levels could also be easily displayed on maps and used in public media advisories. Public outreach meetings could be conducted to notify property owners of flood risks, safety measures, and evacuation routes. There may also be opportunities to integrate this preparedness information into K-12 education curriculum. The 1997 Flood Emergency Action Team flood emergency response and evacuation guidelines provide standardized terminology and information regarding general flood emergency response and evacuation processes that could inform this process.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained. Investigate combining with other consolidated management actions in this category. State participation in this management action (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages

- Low capital cost.
- Reduces long-term emergency response costs.
- Education may lead to more informed decisions and reduced residual risk.

Disadvantages

- Small or non-urban communities may have limited funding and institutional capacity.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Many existing products are available for use as templates to guide these efforts.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential for increased costs at the county level; public information sources and materials, such as websites, maps, and fact sheets, may require ongoing maintenance or updating; and hazard communications plans and related materials would likely need to be reviewed annually to ensure the information is current and correct.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with local governments for developing hazard communication plans and conducting education outreach meetings. Potential for federal cost-sharing (25 percent non-federal, 75 percent federal); under the Pre-Disaster Mitigation Grant Program, up to 10 percent of the grant can be used on public education and outreach related to mitigation.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved communication and public awareness of emergency response procedures and terminology would reduce potential for damages and need for recovery. Effective hazard communication conveys to the public a sense that local officials have considered and planned for how to response to a flood disaster.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change. This management action contributes to emergency response but not to flood fighting coordination.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

Potential decrease. Educating the public on flood risks could help discourage support for development in flood prone areas.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decrease. Improved communication and public awareness would reduce the consequences of flooding and thereby reduce State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potentially improves public safety by increasing public awareness of flood emergency response, and improves the likelihood that the public will comply with direction from officials during the event.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved flood response may protect nearby resources.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Politically and publicly acceptable at the State, regional, and local levels. Some smaller local or non-urban governments may be limited in their funding and institutional capacity to create hazard communication plans and education outreach without additional assistance.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

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Establish standard flood warning systems and procedures

ID MA-065

Description

Problem

Warning affected citizens when a flood emergency is occurring or is imminent promotes public safety. Effective plans to alert the public of personal protective actions they can take currently exist in areas of the Central Valley. However, there are opportunities to enhance these systems. While some jurisdictions have established flood warning systems and procedures, other jurisdictions lack them completely. Additionally, a number of different warning systems are currently in varied levels of use at State, federal, and local levels. Reverse 911 systems place automated calls to deliver evacuation orders or other information to residents in advance of floods and other emergencies, but usually only have the capability to reach residents with traditional land lines--not mobile users or hearing-impaired users with Teletype devices. Some local jurisdictions also make use of traditional sirens or other civil defense alerts; however, as these sirens are rarely accompanied by broadcast instructions, residents may not understand the specific threat to which they are being alerted. The Emergency Alert System, which uses broadcast television, radio, and National Oceanic and Atmospheric Administration (NOAA) Weather Radio to transmit warnings, is also in widespread use at State, federal, and local levels. The State operates the Emergency Digital Information Service, a statewide opt-in e-mail or mobile emergency warning system. This range of warning/alert systems can cause confusion among the public when responding to a flood emergency, prevent warnings from reaching all members of a community, and prevent interconnectivity between systems in use by different jurisdictions.

Desired Outcome

Standardized, integrated flood warning systems and procedures that effectively reach all members of local communities to increase time for the public to implement home and business emergency actions and to improve public compliance with emergency orders.

Methodology

In coordination with existing systems, establish enhanced standard flood warning procedures and terminology, and establish warning systems that can be easily and quickly implemented by 2025. At the State level, this may include DWR working with CalEMA and FEMA to implement a statewide alert and warning system that is consistent with federal warning protocol and procedures but flexible enough to accommodate the various technologies local jurisdictions already use to warn residents. A number of CalEMA reports describe such a system and its related implementation steps. These systems and procedures would be incorporated into local emergency operations plans, as is the current practice.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low capital cost if implementation integrates existing systems.
- Would help reduce loss of life from flooding.
- Would help reduce emergency response costs.

Disadvantages

- Small or non-urban communities may have limited funding and institutional capacity to create and adopt standard warning systems and procedures.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low, for procedural improvements, medium for physical upgrades or modifications of existing alert systems (such as sirens), or installation of new systems.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

None for procedural improvements, increase for implementation that includes physical installation of new alert systems.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with maintaining agencies and local governments for flood warning systems; federal cost-sharing is uncertain under current federal grant/funding opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved flood warning systems and procedures would increase public awareness and preparedness of personal protective actions they can take to respond to flood emergencies.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Region-specific. Some communities without flood warning systems and procedures would likely experience reduced damage to critical infrastructure due to more coordinated emergency response activities. Communities already with warning systems and procedures in place may not experience a change in damages to critical infrastructure.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Depending on implementation, may require CEQA documentation (for instance, noise impacts due to increased use of warning sirens may require environmental documents containing decibel maps).

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Providing early flood warning and notification would improve public safety if coupled with sufficient public education about how to appropriately interpret and respond to alerts.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically acceptable at the State and local levels, particularly since this need has already been documented at the State level. Some smaller local governments may be limited in their funding and institutional capacity to adopt standard flood warning systems and procedures. Additionally, some jurisdictions may understand which systems are most appropriate for their populations and be resistant this action if implementation includes adopting entirely new systems. Another challenge is avoiding multiplying the "warning fatigue" the public can develop when confronted by yet another alert system.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

Improve stream gage network for forecasting purposes

ID MA-066

Description

Problem

Flood forecasting models are limited, in part, by the quantity and quality of available stream gage network data. Additional sensors and stations are needed to improve the quality of flood and reservoir inflow forecasts.

Desired Outcome

Expanded stream gage network and data sensors to improve the quality of flood and reservoir inflow forecasts.

Methodology

DWR would work with the United States Geological Survey (USGS) to install, maintain, and provide priority funding for a comprehensive stream gage network to improve flood forecasting and monitoring. The network would incorporate and update existing USGS and USACE stream-gaging systems, where appropriate. DWR and USGS could also coordinate with other public and private entities to collect and share stream gage data. This network would include real-time gaging and dual-path telemetry for river stage, rainfall, and temperature data. Timely, high-quality forecasting relies on the quantity and quality of real-time data input to forecasting models.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low capital cost.
- High potential for federal cost share.
- Will decrease costs for flood fighting and emergency response and recovery.
- Improves reservoir operations.
- Provides early warning system for floods
- Will help determine the size of a flood event.

Disadvantages

- Requires significant effort to maintain stream gage network.
- Obtaining data from private entities can be challenging.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Primary capital costs would consist of installing new gaging stations.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increased O&M costs for the stream gage network. Long-term flood system maintenance costs would decrease slightly due to improved operations from flood forecasting. Reservoir operation costs may increase very slightly due to flood forecasting efforts and increased coordination with operators.

Potential for Cost-Sharing?

High potential for federal cost-sharing via contributions to existing federal project purposes (flood control and water supply); potential for local cost-sharing, also.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved flood forecasting would provide additional time for emergency response activities.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential decrease. With improved flood forecasting, flood fighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated in advance of flood events. Improved forecasting would also assist in prioritization of flood fight activities and other emergency response activities.

Effect on Damage to Critical Infrastructure?

Flood forecasting would provide more time for mobilization to protect critical infrastructure.

Effect on Floodplain and Economic Development?

No direct effects; however, this action could reduce the frequency of flooding, which may encourage development in the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Improving the stream gage network would result in minor temporary impacts to riparian and aquatic habitat.

Permitting Considerations?

Installation of new stream gage stations may require potentially lengthy permitting processes.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improving flood forecasting would provide early warning and notification to flood management system operators to protect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved reservoir operation due to improved stream gage data may provide indirect water supply and recreation benefits. Increases data available for hydraulic modeling.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve flood forecasting would reside in the State and federal levels of government.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability

This action could enhance hydrologic adaptability by providing data that could increase efficiency and flexibility of flood and water management operations at reservoirs in the system.

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Create systemwide levee instrumentation for early warning systems

ID MA-068

Description

Problem

Flood emergencies in areas protected by the SPFC often result from levee breaks. Warning affected citizens is thus dependent not only on knowing when a flood peak will occur and how large it will be, but also on knowing the condition of the levees protecting those citizens. Currently, a system is in place to provide accurate and frequent information on the river stage at several reporting gauging stations. However, the system is not set up to provide information on the conditions of the levees themselves.

Desired Outcome

A network of telemetered sensors that will provide information on seepage pressures and levee movement to help flood system operators' identify threats to levee stability, and to improve flood fighting and emergency response coordination.

Methodology

Flood forecasting and warning would be supplemented with a system of telemetered sensors (piezometers and Optical-Time-Domain Reflectometry) that would record and transmit seepage pressure and monitor levee movement along critical levee reaches. This would provide comprehensive predictions of floods and warnings of flood danger from overstressed levees. This system could be installed first in levees protecting urban areas and then could be expanded in the future to protect less populated areas. This type of levee instrumentation is currently being pilot tested in the system.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- High potential for federal cost share.
- Would make flood fighting more effective.

- Would decrease costs of emergency response and recovery.
- Politically and institutionally very acceptable.

Disadvantages

- Potentially high cost due to the number of levees.
- Uncertainty regarding where to locate the instrumentation (levees often break in unexpected places).
- Instrumentation is still in the testing phase.

Economic Considerations

Capital Cost? (High, Medium, Low)

Potentially high. Primary capital costs would consist of installing new early warning instrumentation. Due to the number of miles of levees, this could be costly.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Moderate increase in O&M costs related to maintaining instrumentation. But, potentially increases efficiency and effectiveness of future O&M, as maintaining agencies will better knowing which levees are stressed during high water events.

Potential for Cost-Sharing?

High potential for federal cost-sharing via contributions to existing federal project purposes (flood control and water supply).

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved levee early warning instrumentation would provide additional time for emergency response activities.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease. With improved levee early warning instrumentation, flood fighting activities such as sandbagging, constructing protective ring dikes, relocating valuable property, and evacuations could be coordinated well in advance of levee breaks.

Effect on Damage to Critical Infrastructure?

Early warning instrumentation would provide more time for mobilization to protect critical infrastructure.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Decrease. Potential to decrease State responsibility by reducing the consequences of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Installing a levee early warning system could result in temporary or permanent impact to riparian and aquatic habitat depending on site location.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

An early warning system would increase public safety through improved flood fighting and emergency response coordination.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Political acceptability would likely be high across all levels of government. Institutional capacity to improve early warning instrumentation would reside in the State and federal levels of government.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk by reducing the consequences of flooding.

Climate Change Adaptability

Improving levee early warning instrumentation would provide early warning and notification to public safety officials in advance of potential floods, which may increase in frequency as a result of climate change.

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8.0 Flood Fighting, Emergency Response, and Flood Recovery

MA-069: Protect critical infrastructure corridors from floodwaters

MA-070: Expand the State's assistance to maintaining agencies during flood emergencies

MA-071: Facilitate improved evacuation planning

MA-072: Develop a post-flood recovery plan for the Central Valley and Delta to improve the coordination and efficiency of post-flood assistance

MA-073: Streamline the post-flood permitting process for flood system repairs

MA-081: Purchase and pre-position flood fighting materials/tools in preparation for a flood event

MA-094: Integrate environmental compliance and mitigation into the flood fight

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Protect critical infrastructure corridors from flood waters

ID MA-069

Description

Problem

In many Central Valley communities, the infrastructure needed to facilitate the flow of resources into, or evacuees out of, a flooded area would be impacted or incapacitated in the event of a flood. Critical infrastructure includes transportation corridors (highways, roadways), electric power supply, railroads, fuel supply lines, telecommunication systems, water supply and wastewater treatment and distribution facilities (aqueducts, pumping stations), hospitals, and fire and police stations. For example, under various flood scenarios in the City of Sacramento, most transportation infrastructure (major highways, egress routes, lightrail, and Sacramento International Airport) would be partially or completely inundated during a large flood event or levee failure. This could hinder the orderly and timely evacuation of people and animals of value, and impede access by emergency response personnel engaging in flood fighting, evacuation, or other emergency aid functions. In other areas, even if communities are not flooded, they could become isolated if transportation corridors are flooded, posing public safety risks. Flooded transportation corridors could also impede the restoration of lifeline utility infrastructure (water, power, sewer, telecommunications, etc.).

Desired Outcome

Improved emergency response and recovery during and after a flood by protecting critical public infrastructure from floodwaters.

Methodology

The method for protecting critical infrastructure would vary depending upon the size and type of infrastructure, ownership (more than 85 percent of infrastructure is privately owned), location, and characteristics of the flood (depth, rapidity, velocity, time for floodwaters to recede). For example, vital transportation corridors (highways or railroads) could be protected by embankments or by elevation above flood waters. Additionally, alternative transportation methods and locations would need to be identified if primary infrastructure could not be protected. In another example, pumping stations for sewer or water utilities could be flood proofed and equipped with onsite backup power generators. Implementation should consider prioritization of infrastructure to be protected, both regionally and within individual communities, to maximize benefits and cost effectiveness. This will also require consulting with local jurisdictions so as not to duplicate efforts, and working with private utilities who own much of the critical infrastructure.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Increases public safety.
- Improves evacuation/egress and emergency response during flood events.
- Reduces post-flood recovery time.

Disadvantages

- High capital cost.
- Impacts would vary depending on type of infrastructure.

Economic Considerations

Capital Cost? (High, Medium, Low)

High initial investment.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little or no change to operations and maintenance costs.

Potential for Cost-Sharing?

Uncertain potential for federal cost-sharing via contributions to existing federal water resources project purposes (flood management), but existing State and federal programs (Hazard Mitigation Grants Program, Pre-Disaster Mitigation Program, and the National Disaster Assistance Act) may provide funding sources. State-local cost-sharing may also be possible if implementation includes construction of hard structures. Opportunities may also exist to share costs with private sector utilities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to reduce both mid- and long-term costs for flood recovery through reduction in damage to infrastructure (transportation, power, water, wastewater and telecommunications). Potential decrease in emergency response costs due to reduced need for evacuations in areas where power or other critical services had been lost.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Reduces flood fighting costs because fewer structures will need to be protected during the event.

Effect on Damage to Critical Infrastructure?

Directly reduces potential flood damage to critical public, Tribal and private infrastructure.

Effect on Floodplain and Economic Development?

No direct effects to floodplain development; potential to expedite regional economic recovery after a flood event thus reducing overall impact to State, local and national economies.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State liability through reduction in damage to public, Tribal and private infrastructure and improvement in ability to respond to floods (evacuation, emergency access, recovery).

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

Potential substantial permanent impacts to terrestrial and potentially wetland and riparian habitats, including loss of habitat for special-status species.

Permitting Considerations?

Extensive and complex.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety by keeping transportation routes open for emergency response, evacuation, and recovery during and immediately after a flood event, and protecting other infrastructure necessary for timely flood recovery (water, power, gas, etc.).

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Indirect benefit for minimizing flood impacts to archeological sites and sensitive Tribal grounds.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likelihood of implementation would depend on size and type of infrastructure, ownership (federal, State, local, Tribal and private), cost, and potential construction impacts (economic, social).

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Possible hydraulic impacts depending on the kind of improvements; for instance, constructing a new levee or maintaining a setback levee could increase hydraulic impacts.

Effect on Residual Risk?

Reduces residual risks of flooding by preventing damage to critical infrastructure and speeding post-flood recovery.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

Expand the State's assistance to maintaining agencies during flood emergencies

ID MA-070

Description

Problem

Funding available to finance O&M, repairs, and flood fighting varies widely across maintaining agencies, and many have a limited ability to raise funds (particularly during emergencies). For example, flood-fight responders must often seek assistance or funding for rock, supplies, and technical expertise from the next level of local, State, or federal jurisdiction. Most available State and federal funding sources related to floods are aimed at reducing risk and potential damages in advance of a flood or reimbursing the appropriate jurisdiction for eligible emergency response work, not at helping finance operations during flood fights.

Desired Outcome

Improved capacity of maintaining agencies to obtain funds quickly to finance flood fighting activities during a flood event or when a other threats to levee stability are imminent.

Methodology

There are a number of ways the State could facilitate financial liquidity for maintaining agencies when a flood fight is imminent. One is creation of a public loan guarantee program that would promise to assume maintenance districts' debts from loans obtained to help finance flood flights in the event that districts cannot repay them immediately. This would allow even very small agencies to purchase the resources and expertise needed to help hold back floodwaters. However, such a program may complicate local efforts to seek FEMA funding assistance after the event, and would also need a repayment structure. Another option is the creation of an emergency fund; DWR is already in the process of developing such a fund.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Directly benefits agencies responsible for maintaining flood management facilities.

Disadvantages

- Sustainable funding source would need to be identified.

Economic Considerations

Capital Cost? (High, Medium, Low)

Variable, depending on type and magnitude of program.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Operations and maintenance costs would not change.

Potential for Cost-Sharing?

Could increase State cost-sharing in emergency management.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential decreased cost due to improved emergency response activities at local level.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential decreased cost due to improved local agencies' ability to flood fight and conduct emergency activities.

Effect on Damage to Critical Infrastructure?

Could minimize public, Tribal and private utility infrastructure damage during disaster events.

Effect on Floodplain and Economic Development?

No direct effects.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Could reduce State responsibility that may result from flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

No direct effects, but increased funding for improvements would result in a flood management system that provides greater public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support, particularly at local level; would require the identification of sustainable funding, which may require changes to laws and regulations governing the generation of funds for flood system maintenance and repairs.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

No direct effects.

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Facilitate improved evacuation planning

ID MA-071

Description

Problem

Few local jurisdictions have prepared flood-specific evacuation plans, either locally or regionally. Some local jurisdictions have produced flood evacuation plans that identify the range of involved agencies and personnel, notification procedures, public and private transportation options, evacuation routes, and other related information for flood emergencies. Others integrate these plans into their overall emergency plans. Only a few jurisdictions have distilled flood emergency preparedness and evacuation information into succinct summaries easily accessible and understandable by the public.

Desired Outcome

Increased coordination across emergency response agencies and greater public awareness of proper evacuation procedures to reduce loss of life during severe flood events.

Methodology

Work with CalEMA to reach out to local emergency management agencies and officials to assist them in developing or updating local flood evacuation plans that identify the range of involved agencies and personnel, notification procedures, public and private transportation options, and evacuation routes/procedures that are easily accessible and understood by the public. These plans should also consider ingress routes for flood fighters while an evacuation is occurring. DWR would also consider working with CalEMA to update the 1997 Flood Emergency Action Team (FEAT) legal guidelines for flood evacuations through the State Emergency Management System Advisory Board. Important tools in this effort include the FEAT guidelines for flood emergency operations and ordering evacuations, as well as other mapping tools, vulnerability assessments, and other products from State or regional agencies that could help public safety agencies make decisions on ordering evacuations.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low capital cost.
- Likely to be politically popular.
- May improve coordination between operational areas and communities.
- Uses existing tools and guidelines.

Disadvantages

- Limited funding and institutional capacity from small and non-urban communities for implementation.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy management actions will tend to have a substantially lower capital cost than other management actions which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with maintaining agencies and local governments for evacuation planning and training; federal cost-sharing is uncertain under current federal grant/funding opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Evacuation planning would improve coordination across all emergency response staff involved in evacuation. Improved public awareness of evacuation procedures would also reduce the need for "sweeping" by emergency responders to ensure individuals in a response area have evacuated.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No direct effect, but consideration of ingress routes for flood fighting (as part of evacuating planning) could facilitate emergency response.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease. Improved evacuation planning could reduce consequences of flooding but will not reduce the frequency of potential flood threats.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Significantly improves public safety by minimizing loss of life through improved emergency response coordination and more efficient evacuation during severe floods.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to be politically acceptable at the State and local levels. Some smaller governments may be limited in their funding and institutional capacity to create evacuation plans without additional assistance.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Reduces residual risk. Creating and coordinating evacuation procedures reduces the consequences of flooding (potential impacts to life and property).

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

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Develop a post-flood recovery plan for the Central Valley and Delta to improve the coordination and efficiency of post-flood assistance

ID MA-072

Description

Problem

Many existing Central Valley post-flood recovery plans and programs leave room for improvement in clarity and integration. The variability in flood emergency planning throughout the Central Valley's communities is mirrored in the range of comprehensive post-flood recovery plans documented. Where they exist, these plans are generally driven by the eligibility requirements of the Stafford Act. Debris removal and economic recovery operations are often conducted well after floods, but often only to the extent that they are eligible for limited State disaster assistance funds and/or federal reimbursement and assistance through FEMA, United States Department of Agriculture (USDA), and other agencies. Coordinating post-flood recovery activities can be difficult because the range of agencies with legal or voluntary responsibilities for disaster recovery often cross jurisdictions and levels of government.

Desired Outcome

A simple, direct, integrated plan of action for post-flood recovery to reduce confusion, clarify roles and responsibilities, and facilitate expedited disaster recovery throughout the Central Valley and Delta.

Methodology

Work with CalEMA, FEMA, local agencies or organizations, tribes, and others to: identify all responsible people, agencies, or organizations with disaster recovery roles and responsibilities; detail relevant recovery activities, including levee repair, flood water evacuation, and property and infrastructure rehabilitation; establish or describe timelines and protocols for accomplishing recovery activities; and identify all State, federal, and non-governmental sources of potential disaster assistance funding, both general and flood-specific. Use the information in the 1997 FEAT products related to post-flood disaster assistance, and consider working with CalEMA to revise the guidelines through the State Emergency Management System Advisory Board.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained. It may not be practical to develop one post-flood recovery plan for the Central Valley and Delta. Should investigate combining with other consolidated management actions in this category. State participation in this management action (funding, coordination, planning assistance) should not constitute State responsibility for implementation activities and their effects.

Advantages

- Low capital cost.
- May reduce repair costs.
- Increases likelihood of completion of post-flood recovery actions.
- Improves effectiveness of recovery efforts and provides direction during post-flood confusion.

Disadvantages

- Some smaller governments may be limited in their funding and institutional capacity to develop and implement post-flood recovery plans.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low. Policy management actions tend to have a substantially lower capital cost than other management actions which involve physical construction. Capital investments include funding for multiagency, multijurisdictional planning and development of post-flood recovery plans.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease. Increased post-flood recovery planning prior to flood events reduces maintenance and repair costs for maintaining agencies.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with maintaining agencies and local governments for post-flood recovery planning. Federal cost-sharing is uncertain under current federal grant/funding opportunities. Potential for State cost-sharing under existing grant programs. Opportunities for public-private partnerships may also exist.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Improved post-flood recovery planning increases the efficiency and effectiveness of post-flood recovery efforts.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Decrease. Post-flood recovery planning establishes roles and responsibilities for rehabilitation, repair, or replacement of critical infrastructure (e.g., hospitals, communication centers, utilities, schools, government operations, transportation routes, etc.) damaged by flooding. Improvements in floodwater evacuation also help protect critical infrastructure.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease. Improved post-flood recovery planning may reduce the need for State assistance.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Improvements in post-flood levee repair, floodwater evacuation, and rehabilitation of critical infrastructure all improve public safety in the aftermath of a disaster.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Likely indirect benefit of quicker rehabilitation and re-opening of recreational facilities following a flood.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Politically and publicly acceptable at State, regional, and local levels. Institutionally, there may be difficulties with ONE plan for the entire area (unless there is resolution of inconsistencies related to agency responsibilities in various regions). Some smaller agencies may be limited in their funding and institutional capacity to develop post-flood recovery plans.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

No reduction in residual risk.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

Streamline the post-flood permitting process for flood system repairs

ID MA-073

Description

Problem

Obtaining permits for post-flood system repairs involves coordination with multiple agencies that can exceed the staff resources and budgets of smaller maintaining agencies. With multiple permits required for most maintenance and mitigation activities, and no central location for coordinating the process, obtaining the necessary permits often takes longer than the actual repairs.

Desired Outcome

Reduced costs and time needed to complete system repairs.

Methodology

State and federal agencies involved in the permitting process would coordinate to develop a consistent permitting program that is easy to understand and comply with at the local level. Permit applications submitted to State and federal agencies through the permitting program should have priority in the review process, allowing permits to be issued in a timely manner so that repairs of damaged levees could begin shortly after a flood event. In addition, the Board could establish a process for issuing a blanket permit for recovery-type work following a high-water event. A potential model for a streamlined permitting process is the methodology DWR used to facilitate more than 29 critical levee erosion repairs performed in 2006.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduces operations and maintenance costs for maintaining agencies, possibly freeing up funding for more system repairs.
- Reduces the time required to begin post-flood repairs.

Disadvantages

- Potential resistance from permitting agencies.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium. While policy management actions tend to have a substantially lower capital cost than other management actions which involve physical construction, interagency coordination (on the State and federal levels) would be required to streamline the permitting process for flood-system repairs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease. Obtaining permits represents a significant cost of operation, maintenance and repair activities. Streamlining the permitting process should reduce costs for maintaining agencies.

Potential for Cost-Sharing?

Yes, potential for State and federal cost-sharing.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

If streamlining the permitting process results in more timely post-flood repairs, this will reduce the frequency of flooding and thereby reduce the long-term costs of emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

If streamlining the permitting process results in more timely post-flood repairs, this will reduce the frequency of flooding and thereby reduce the long-term costs of emergency response and recovery.

Effect on Damage to Critical Infrastructure?

Timely repair of flood damage could reduce the risk of damage from future floods.

Effect on Floodplain and Economic Development?

No direct effects; however, if the repairs results in reducing the frequency of flooding and increasing the level of flood protection, floodplain development may be encouraged.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease in State flood responsibility due to the repairs reducing the frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

If streamlining the permitting process results in more timely post-flood repairs, public safety is improved by reducing the frequency of future flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Streamlining the permitting process should be very popular with maintaining agencies because it would reduce the time and funding required to obtain permits. Likely to be politically and publicly acceptable. State and federal permitting agencies may oppose this effort if it appears to render permit requirements less stringent or infringe upon their authority or jurisdiction.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

If streamlining the permitting process results in more timely post-flood repairs, the frequency of future flooding and therefore the residual risk would be reduced.

Climate Change Adaptability

Unrelated to hydrologic and biological adaptability.

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Purchase and pre-position flood fighting materials/tools in preparation for a flood event

ID MA-081

Description

Problem

During a flood event, considerable quantities of flood-fighting materials (e.g., rock, sandbags, lumber, sheetpiles, other supplies) are often needed with minimal advance notice. Waiting until an event occurs to locate, purchase, and transport materials (mobilizing barges or other transportation) can slow the response to a flood emergency, especially one that requires more than basic sandbagging and levee patrol. In addition, during an event, the ability of local agencies to obtain funding to support purchasing and positioning materials is limited because contingency funding is small or nonexistent and banks are reluctant to lend when the tax base used to repay those loans is itself at risk. Many communities also have local ordinances that restrict industrial traffic in the evenings, making transport of materials difficult.

Desired Outcome

Flood-fight materials/tools strategically located to improve flood-fight response times and reduce emergency costs and damages associated with a lack of timely access to these resources.

Methodology

Assess DWR's existing pre-positioned flood-fighting caches. Flood-fighting materials could be purchased in advance of flood events and stockpiled at materials storage and transfer facilities. These material storage and transfer facilities could be located both locally (for immediate access) and regionally (near barge loading facilities or protected transportation corridors) and stocked based on assumptions related to the magnitude of flood event for which a response is desired, miles of levees supported, etc. Stockpiles could be managed by both DWR and local agencies to provide access to bulk materials (rock, lumber, sheetpile) and portable materials (sandbags, plastic, etc.). DWR has a successful history of sharing stockpiled material. Development of mutual aid agreements that facilitate the coordination and sharing of flood-fighting materials could also be facilitated to leverage available funding (State, federal, regional, local) and supply resources. USACE has 3-to 5-year IDIQ contracts, renewed annually, that direct quarries to deliver materials as requested, but California government code prevents State representatives or officials from entering into any contracts without available funding – an uncertainty given State budget problems. Local agencies could also pre-fund an emergency or flood-fighting fund that could be accessed during a flood event.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained. State participation in this action (funding, coordination, planning assistance) should not constitute sole State responsibility for the materials, their upkeep, or their use.

Advantages

- Greatly increases availability and accessibility of flood fighting materials, especially for communities that lack easy access to these materials.
- DWR has implemented similar existing programs in the past that this action could build off of.

Disadvantages

- High capital costs.
- Long-term storage and upkeep costs.
- Limited applicability by region.

Economic Considerations

Capital Cost? (High, Medium, Low)

High. Majority of costs are upfront capital expenditures.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Slight increase related to storage and upkeep of flood fighting materials.

Potential for Cost-Sharing?

Yes. Potential cost-sharing with local, regional, State, and federal agencies for purchase and storage of materials.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Access to and effective use of flood fighting materials may reduce potential for damages and need for recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease. Pre-purchased flood fight supplies reduce the need for purchases made with emergency loans. Depending on the storage location, transporting the materials may still incur some costs.

Effect on Damage to Critical Infrastructure?

Decrease. Ensuring the accessibility and availability of flood fighting materials may hold off a flood or allow responders to construct protective barriers around threatened structures, for instance.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential decrease. Accessibility and availability of materials improve flood fighting and thereby reduce the magnitude and frequency of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potentially improves public safety by improving ability to respond to threats to levee stability, thus reducing chance of levee failure.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Improved flood fighting may protect nearby resources.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High capital cost may reduce political and institutional support .

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Potential for redirected impacts (if not implemented in a coordinated manner and systemwide).

Effect on Residual Risk?

Reduces residual risk by enhancing responders' ability to quickly react to threats to levee stability, thus reducing chance of levee failures.

Climate Change Adaptability

Adaptable to climate change, as flood fighting materials positioning could take into account the future impacts of climate change.

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Integrate environmental compliance and mitigation into the flood fight

ID MA-094

Description

Problem

Flood-fighting activities can sometimes lead to environmental violations (under CEQA and/or National Environmental Policy Act [NEPA]) that require extensive mitigation requirements or result in an agency's disqualification for emergency funding reimbursements following an event. Most flood fights occur on or near levees, which means sensitive wetland habitat or riparian areas may be damaged by construction, heavy equipment, use of rockpiles, and other activities that occur during flood fighting.

Desired Outcome

Reduced incidence of environmental violations occurring during a flood fight.

Methodology

Maintaining agencies would hire or contract for in-house environmental compliance specialists on flood fighting and who can help prepare and train crews to minimize impacts to sensitive areas when addressing threats to levee stability. As soon as a flood risk is identified, these staff would be involved in the field to help coordinate the flood fight; as the flood threat is assessed, they would also assess potential environmental impacts on existing conditions that could occur in flood fighting. Coordination with resource agencies, dialogue with FEMA, and dialogue with flood fighters will help to ensure they understand the roles of environmental compliance when responding to flood threats. DWR has assigned dedicated environmental compliance specialists to its flood operations center who successfully operate in this capacity.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Improves cost recovery.
- Increased/enhanced environmental protection.
- Expedited environmental assessments.

Disadvantages

- Potential to delay flood-fight response if training and preparation does not occur.
- Smaller maintaining agencies may not have the resources to hire or retain environmental compliance specialists.

Economic Considerations

Capital Cost? (High, Medium, Low)

Increase. There are additional costs to hire or train an environmental compliance/resource manager. However, these costs should be somewhat offset by no longer needing to hire outside consultants after a flooding event to assist with more extensive mitigation.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Increase. However, costs to have an environmental compliance specialist on staff should be somewhat offset by no longer needing to hire outside consultants after a flooding event to assist with more extensive mitigation.

Potential for Cost-Sharing?

There may be opportunities to share costs between State and local sources.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Decrease. Avoiding costly mitigation will decrease the overall recovery costs, and will increase opportunities for emergency cost reimbursement.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Flood fighting costs will not be directly affected, however costs to the flood operations center may increase due to having an in-house environmental compliance/resource manager.

Effect on Damage to Critical Infrastructure?

None.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

None.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

No direct effects, but potential damages may be avoided or minimized.

Potential for Adverse Environmental Impacts?

No.

Permitting Considerations?

Will not decrease permitting requirements, but will improve efficiency of the permitting process and will decrease mitigation due to environmental violations.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

May have ancillary effect of reducing environmental impacts during system repairs following a flood.

Social Considerations

Contribution to Public Safety?

No change.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No change.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This action would be harder to implement in smaller communities with fewer resources, but would be popular with resource agencies.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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9.0 Policy and Regulations

MA-049: Encourage compatible land uses with flood management system and floodplain function

MA-050: Establish clear triggers or policy for updating flood management-related General Plan elements and other local flood management plan(s)

MA-051: Update State’s designated floodway program

MA-052: Use Building Standards Code amendments to reduce consequence of flooding

MA-053: Update the State's floodplain management policy

MA-057: Encourage multi-jurisdictional and regional partnerships on flood planning and improve agency coordination on flood management activities, including O&M, repair, and restoration

MA-058: Develop and implement State criteria and processes for urban flood protection

MA-084: Develop and implement flood protection criteria outside urban areas

MA-085: Update State Title 23 standards

MA-086: Clarify flood management responsibilities for all local, regional, State, and federal agencies

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Encourage compatible land uses with flood management system and floodplain function

ID MA-049

Description

Problem

Much of the new development in the Central Valley is occurring in the floodplains. Urbanization in floodplains increases the potential for flood damage to homes, businesses, and communities. Land-use decisions made at the local level often allow development in floodplains and create situations that are incompatible with the flood management system and existing flood protection for the area. Some assert that a limited understanding of the beneficial functions of floodplains has resulted in floodplain management decisions often being made outside of the context of watershed-level planning and without adequate consideration for natural and beneficial floodplain functions.

Desired Outcome

Compatible land-use decisions at the local level with flood management system and flood plain function. Decisions made at the local level that provide flood protection can also benefit the community with areas of open space, parkways, trails, or habitat lands.

Methodology

The State should encourage counties, cities, school districts, and other local jurisdictions with land-use authority to identify and delineate appropriate and allowed urban and rural land uses within floodplains in the Central Valley and identify ways that flood-prone lands can serve multiple uses, such as for groundwater recharge, recreation, or habitat. The State could define criteria for how developers know if they are meeting standards for development in areas that are at risk of flooding. In addition, the State could work with counties to promote urban development that attempts to retain existing or natural hydrologic conditions through the employment of low-impact development techniques. Low-impact development techniques seek to maximize the area available for infiltration so that peak flow rates, runoff volume, and pollutant concentrations are reduced. Research should also be conducted and recommendations made regarding compatible cropping or agricultural practices for certain areas to reduce flood damages to agricultural areas.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance

- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- The consistency of land use compatibility considerations between the State and local jurisdictions would further align the strategy for long-term sustainability.

Disadvantages

- The State does not have land use authority, which is held by local jurisdictions.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Measures put in place consist of policies, best management plans, financial incentive programs, educational programs, and does not involve physical construction. Costs for this action would include administrative costs for both the State and local entities.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease in O&M costs. Increased integration of land use planning with flood management will result in land use practices that are more compatible with the flood management system and the natural system, which may reduce stress on the flood management system and hence provide a net reduction in O&M and repair. LID will reduce runoff and lower peaks, which could also reduce stress on system.

Potential for Cost-Sharing?

Federal, State and local agencies would be involved. Potential cost sharing through federal and State grant/loan programs, cost sharing agreements, and developer-based incentives.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease long-term costs for emergency response and recovery. The frequency and consequences of flooding would be reduced.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Reduction in frequency and consequence of flooding would decrease long-term costs of flood fighting.

Effect on Damage to Critical Infrastructure?

Long-term reduction in damage to critical infrastructure. Best management practices would direct placement of critical infrastructure.

Effect on Floodplain and Economic Development?

Directly effects floodplain development. Land use decisions would be made from a watershed level and land use decisions would be compatible with flood management system uses.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing frequency and consequences of flooding.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Comprehensive land use planning in floodplains could result in rehabilitation of key physical processes and ecosystem functions by identifying and setting aside areas where rehabilitation would be most beneficial for habitats and flood management and restricting development there.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

Land use decisions the have potential to change existing permitting process.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by reducing frequency and consequences of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential to provide other benefits, such as recreation, water supply through enhanced recharge, agriculture, and habitat enhancement.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Implementation is compatible with the current legislation requirements to address flood hazards in local land use planning, and the State's policy for preserving land use authority with local jurisdictions.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Potential reduction in consequences could reduce residual risk.

Climate Change Adaptability

This action would enhance hydrologic adaptability by providing additional capacity to convey flood flows and reducing the consequences of the increased flood frequencies and greater flows anticipated to result from climate change; also, the use of LID techniques could decrease peak flows, and thus, reduce the impacts of extreme precipitation events. This action also could enhance biological adaptability by increasing habitat quantity, connectivity, and continuity along environmental gradients; and thus, increasing the ability of species to handle and adjust to the consequences of climate change.

Establish clear triggers or policy for updating flood management-related General Plan elements and other local flood management plan(s)

ID MA-050

Description

Problem

The most recent and applicable data is not always available or used for updates to local flood management and land-use planning documents, resulting in outdated planning strategy and reduced benefits. Many flood-related regulations and planning are associated with a defined level of protection, in other words, an event of certain return frequency. The frequency-based management strategy would often be impacted by significant events that change the statistics and/or consideration of the climate change effects and uncertainties in hydrologic condition forecast.

Desired Outcome

More proactively and adaptively managed floodplains by the State and local agencies. With access to the most recent hydrologic, climate, physical and biological conditions, policies, and land-use data planning documents for land-use and flood management can be better updated.

Methodology

The State should update the general plan guidelines to reflect the California Floodplain Management Task Force recommendations, as applicable, and to reflect other programs, policies, and standards, including the NFIP, for floodplain management. Similarly, local jurisdictions should update their general plan and other flood management plan(s) to reflect the updates. At a minimum, the update should be triggered by the 5-year update of the CVFPP and occurrence of major flood events that change the frequency of events used as reference in the local plans. New data developed by local agencies for flood management planning purposes (e.g., new hydraulic models) should also be integrated into planning documents when updated.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Having clear triggers for policy and General Plan updates will remove confusion as to what the local entities are to do in response to the adoption of the CVFPP.
- Improves overall public safety, property protections and provides economic benefits statewide.

Disadvantages

- Not all local agencies will react the same to a "clear" trigger, some will try to use their own interpretation as long as it suits their needs.
- How will trigger be defined? An example is the 1997 storm event on Butte Creek in Butte County. The March 4, 2005 flood workshop defined the Butte Creek event as a 61 year event in the valley and a 118 year event for the neighboring Big Chico Creek watershed. The flows in Butte Creek exceeded the FEMA 500-year event. What would you use for the trigger and how would you rate the event if a levee failed?
- Some requirements could be politically sensitive.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Measures put in place consist of policies, plans, improved tools, and does not involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change on O&M costs in the short-term. Potential decrease in long-term O&M costs. Improvements in flood planning could result in management practices that are more compatible with the flood management system and the natural system, which may reduce stress on the flood management system and hence provide a net reduction in O&M and repair.

Potential for Cost-Sharing?

No specific cost-sharing opportunity identified. However, the federal and State agencies could identify the level of acceptable information used in local plans as part of the criteria for determining cost share, federal and State grant/loan programs and other incentive programs.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Improved and updated land use and other management plans would potentially decrease long-term costs for emergency response and recovery. Improved land use and flood management planning should improve ability to manage floods and reduce the frequency and consequences.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Updating general plans would help encourage compatible land uses with floodplain functions. Compatible land uses could contribute to both reduction in frequency and consequence of flooding, which would decrease long-term needs of flood fighting.

Effect on Damage to Critical Infrastructure?

Long-term reduction in damage to critical infrastructure. More frequent and comprehensive updates of land use plans would provide better guidance for planning and placement of future critical infrastructure, reducing chances for damages.

Effect on Floodplain and Economic Development?

Directly effects floodplain development. Land use planning would be more robust given the better data, tools, and frequency of updates.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility by reducing consequences of flooding through land use planning.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Likely, but potential will depend on whether the concept of rehabilitating key physical processes and ecological functions was originally incorporated in the General Plan or flood management plan. If rehabilitation was incorporated in the original design updates would continue to improve this intent, making it more current and durable. Positive effects of this management action are most likely to come from other management actions compatible with this one.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by avoiding putting residents at risk through land use planning in comparing scenario without proper/timely updates.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential to provide other benefits through improved land use planning, which could provide recreation, water supply, agricultural, and habitat benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Overall, improved land use management would be favorable to overall general public, government agencies, but some resistance by cities/counties that depend on tax base, and development industry.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

Potential reduction in consequences could reduce residual risk in comparing scenario without proper/timely updates.

Climate Change Adaptability

Updated land use plans that incorporate climate change scenarios could support enhancement of hydrologic adaptability by incorporating flexibility and additional capacity into the system, and thus, reduce the consequences of the increased flood frequencies and flows anticipated to result from climate change. If these land use plans provide opportunities for restoration of habitat, this action could enhance biological adaptability by increasing habitat quantity, complexity, connectivity, and continuity along environmental gradients.

Update State's designated floodway program

ID MA-051

Description

Problem

The existing designated floodways are based on the passage of the 55/57 design flood. The designation requires reevaluation because of the 2007 Flood Legislation that specifies an increase in the desired level of protection for the urban and urbanizing areas to 200 years or greater, improved understanding of hydrologic conditions based on the past several severe floods, and potential changes in hydrologic conditions due to climate change.

Desired Outcome

To ensure consistency with the current requirements and understanding of hydrologic conditions with additional floodways designated as part of the SPFC.

Methodology

"Designated floodway" refers to the channel of the stream and that portion of the adjoining floodplain reasonably required providing for the passage of a design flood; it is also the floodway between existing levees as adopted by the Board or Legislature. The existing designated floodways are based on the passage of the 55/57 design flood. To provide 200-year (or greater) level of flood protection to all urban and urbanizing areas in the Sacramento-San Joaquin Valley by December 31, 2025, the State will need to define the 200-year flood based on an updated understanding of valley hydrology and redraw maps of designated floodways. This effort would be coordinated with the ongoing efforts to update the hydrologic and hydraulic modeling tools by the USACE and DWR.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Designated floodways are a necessary part of the approach to accomplish the desired level of protection.

- The update and reevaluation of needs would help to establish the active management of floodway sections to reduce chance of flooding.

Disadvantages

- May eliminate opportunity for urban development within boundaries of new floodways.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Non-structural policy management actions will tend to have a substantially lower capital cost than other management actions which involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change in O&M costs and repair costs.

Potential for Cost-Sharing?

No specific cost-sharing opportunity identified for updating the designated floodway.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change to emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change in flood fighting costs.

Effect on Damage to Critical Infrastructure?

Long-term reduction in potential damage to critical public infrastructure as a result of updating designated floodways.

Effect on Floodplain and Economic Development?

Could eliminate opportunity for urban development due to designation of new floodways. However, could provide opportunities for other development, both within the new designated floodway (agricultural, recreational, and habitat uses) and also in neighboring communities that might have the benefit of improved flood protection that would allow for expansion of development in existing floodplains.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by eliminating opportunities for urban development in the designated floodway.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Similar to adoption of a land use general plan, if changes to policy or regulations would result in project implementation (e.g., physical impacts), CEQA compliance would be required.

Permitting Considerations?

Permitting may be required if policy is implemented and if there are impacts to regulated resources.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to improve public safety by reducing consequences of flooding.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Increased potential for other benefits, such as agriculture/recreation/habitat in new designated floodways, through encouraging compatible land uses.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Would have strong support from urban communities in need of greater protection; and less support from environmental and rural communities that would receive less benefit or no benefit, of new floodways.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

This action involves changes to designated floodways from impacts to hydrology due to climate change projections.

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Use Building Standards Code amendments to reduce consequence of flooding

ID MA-052

Description

Problem

Mandatory building provisions related to flood protection that are required for the Special Flood Hazard Area (100-year floodplain) are provided by local Flood Management Ordinances. These ordinances address flood protection mainly through elevation of structures. The economic viability of this approach is limited in the Central Valley where flood depths could be more than 20 feet. The 2007 Flood Legislation requires amendments to the California Building Standards Code for construction in areas protected by the facilities of the CVFPP where flood levels are anticipated to exceed three feet for the 200-year flood event to reduce the risk of flood damage. These required building codes amendments go beyond the 100-year floodplain, to areas where the 200-year event exceeds 3 feet and would be reflected in the community building code.

Desired Outcome

Protect residents in the Central Valley from death and severe injury during floods, and increase the resilience of the building to reduce damage and required time for recovery with additional mandatory building code provisions.

Methodology

The 2007 flood legislation provides guidance in developing building code amendments to protect lives and reduce flood damage in the SPFCPA, where the flood depth is expected to be above 3 feet in a 200-year event. The focus is on the deep floodplains in the Central Valley with high possibilities of floodwater ponding. Building code amendments can include various structural improvements for public safety reasons and for dry and wet proofing tactics to reduce overall consequences of flooding. The proposed building code amendments need to be adopted by the California Building Standard Commission, as either mandatory or voluntary requirements. The development of proposed code amendments would be consistent with the national standards and other California code development trends. Due to the various types of buildings and business sectors associated with each building occupancy categories, the requirements may have to be customized for individual occupancy, in coordination with relevant State regulatory agencies and major industrial and professional groups. During the 2009-2010 code adoption cycle, DWR proposed code amendments to buildings in the Single-Family Residential (R-3 and R-3.1) occupancies groups protected by the facilities of the CVFPP. Cost estimates for required improvements and upgrades for single family residential houses were completed on a voluntary basis. DWR received the approval from the Building Standard Commission to adopt the amendment on January 12, 2010. Currently, DWR is embarking on a review of various other occupancy types with an initial focus on educational, institutional, and Emergency

Responders occupancies. As with most building code amendments, the proposed code amendment would apply to new construction and existing buildings that require significant improvement and upgrade.

Contributes Significantly to CVFPP Goal:

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s):

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained):

Retained; maintaining the scope consistent with the Health and Safety Code Section 50465, as authorized in the 2007 Flood Legislation as the CVFPP development.

Advantages

- Reduce the potential flood damage and life loss in deep flooding conditions.
- Increase the level of accessibility for rescue, the building resilience for faster recovery.
- Decrease the burdens of State and federal programs for emergency response, recovery and assistance in the long run.
- Reduces residual risk regardless of the accomplishment from the reduction of chance of flooding.
- Promote reasonable land use planning and building integrity in deep floodplains.

Disadvantages

- Significant agency and interest group coordination is required because of the various occupancy groups that may be affected by the proposed code amendment, and customization is required.
- The intended evacuation direction for a building in a deep flooding condition is opposite to the current evacuation routes established for most disasters or emergency; therefore, public education is likely to be a significant challenge.
- The associated ADA requirements, where they apply, could also pose a significant compliance and cost challenges for some sectors such as commercial buildings and schools.
- The application of building code amendments is limited to new constructions and existing buildings with significant improvement and upgrade; therefore, it would not provide a uniform improvement on building safety and resilience during floods.

- Should the code amendment be adopted as voluntary items, the reinforcement and the anticipated outcomes may vary significantly from jurisdiction to jurisdiction.
- Does not meet the regulatory requirement to **protect** the structure from flood damage.

Economic Considerations

Capital Cost? (High, Medium, Low)

Relative low capital costs for implementing code changes. Cost to change codes relatively low. The additional cost to implement the new codes, such as the added costs of building officials reviewing plans and permitting applications, could be recovered through additional fee requirements or development agreements. The additional cost to developers for meeting the new code requirements would be recovered through additional fees added to the lease or purchase price of the property.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

There may be an increase in costs associated with increased enforcement, inspection, and potential flood drills, subject to the actual code proposal.

Potential for Cost-Sharing?

No specific cost-sharing opportunity identified.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to facilitate rescue activities during deep flood conditions, decrease long-term costs for emergency response and recovery through the reduction of flood damage to property.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

Potential to improve building construction of critical infrastructure, preserve the function and/or reduce damage to critical infrastructure, and enable faster recovery if improvements on floodproofing tactics and material are used.

Effect on Floodplain and Economic Development?

There may be economic effects on some business sectors; however, this would be evaluated by the California Building Standard Commission as part of the adoption process. The building code amendment may encourage different types of buildings to be developed in the floodplain, but not likely to have significant impacts on local economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease the State's responsibility in emergency response and local assistance programs.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Changes to policy or regulations would result in project implementation (e.g., physical impacts) CEQA compliance would be required.

Permitting Considerations?

Permitting may be required if policy is implemented and if there are impacts to regulated resources.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Potential to increase public safety through implementation of floodproofing, elevating, and other building improvements that allows egress during a flood event.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

If properly scoped and coordinated, the building code amendment would be implemented -- as shown by the 2010 adoption of the code amendment for single residential buildings.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

The building code amendment will reduce the residual risk.

Climate Change Adaptability

The building code amendment should be considered in coordination with other regulatory developments for climate change, including the land use planning and specific building code amendment (such as the Green code adopted in 2009). The accumulative effects of various regulations and law requirements should be considered for their consistency to improve climate change adaptability.

Update the State's floodplain management policy

ID MA-053

Description

Problem

FEMA has notified the State that the existing Governor's Executive Order B-39-77 does not effectively bring the State and its political subdivisions into compliance with the NFIP. This could endanger the State's ability to obtain federal financial assistance, including federal disaster assistance and USDA and U.S. Department of Housing and Urban Development funding, for buildings located in FEMA's regulatory floodplains. Specifically, Executive Order B-39-77 exempts public entities, such as schools, universities, and public agencies, from county building code permitting requirements. However, since the original executive order was issued, California has adopted the International Building Standards (ASCE-24) into the State Building Standards Code, which addressed many of the inconsistencies among State, federal, and local regulations regarding building codes and development within floodplains that could affect NFIP eligibility. Federal Executive Order 11988, which sets federal floodplain management policy, is currently being updated.

Desired Outcome

An updated Governor's Executive Order to be consistent with the federal Executive Order setting floodplain management policies. The California Building Standards Code and other codes applicable to public buildings would meet, at a minimum, NFIP requirements. Any local code adoptions or amendments and any development approvals could also meet, at a minimum, NFIP requirements.

Methodology

Update Governor's Executive Order B-39-77, which directs California's policies for building public and private facilities within floodplains. The update could be based on the Federal Executive Order on floodplain management, which is in progress of being updated. It could also incorporate the recommendations from the California Floodplain Management Task Force in 2002, or developed through a method of equivalent effectiveness.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Updating the policies and regulations so they are consistent will continue to allow California to be eligible for participating in NFIP, and allow local agencies to receive future federal financial assistance.
- There are minimum costs for updating the policies and regulations, however, there is a higher cost for actual implementation of them.

Disadvantages

- Adoption and enforcement by local jurisdictions can be affected by resources limitations; however, this challenge may have relationship to the lack of understanding for their actions related to their eligibility of NFIP coverage and financial assistance.
- Potential political challenges with adoption and enforcement.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Policy management actions will tend to have a substantially lower capital cost than other management actions which involve physical construction. Upon implementation, which could require retrofitting existing buildings to be compliant, could result in higher costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Potential for federal grants and local cost-sharing associated with actions needed to meet requirements.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to decrease the consequences of flooding; thereby reducing long-term costs of emergency response and recovery.

Flood Fighting Cost? (Increase, Decrease, or No Change)

None.

Effect on Damage to Critical Infrastructure?

Potential reductions in damage to critical public infrastructure if compliance with the elevation requirements. Additional federal assistance may help the recovery of critical public infrastructure.

Effect on Floodplain and Economic Development?

The continued eligibility for NFIP and federal financial assistance is critical for existing and future floodplain and economic development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

The ineligibility for NFIP and federal financial assistance will potentially increase the State's responsibility in flood disaster assistance, which traditionally relies on federal support significantly.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

Could impact permitting process and decisions

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

May improve public safety by reducing consequences of flooding, and provide greater opportunities for financial assistance to reduce secondary consequence of flooding on public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Could impact decisions regarding open space, water supply, parks and recreation

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Significant support for this management action at the federal and local levels. Funding for local agencies has been challenging. Implications to construction industry may create hurdles. Could be politically sensitive, and create economic burden without significant federal and State funding options.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

NFIP and financial assistance are major strategies in addressing residual risks.

Climate Change Adaptability:

Under consideration by NFIP.

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Encourage multi-jurisdictional and regional partnerships on flood planning and improve agency coordination on flood management activities, including O&M, repair, and restoration

ID MA-057

Description

Problem

Flood management is often complicated by the large number of agencies and entities involved, and their complex jurisdictional roles and responsibilities. Overlapping jurisdictions across various State and federal agencies involved in flood management can lead to inconsistent policies and regulations, conflicting guidance, or inefficiencies in planning and implementing projects. Coordinating activities within this fragmented jurisdictional landscape can be challenging, particularly for local entities with limited resources.

Desired Outcome

Streamlined, efficient, and cost-effective flood management through greater coordination.

Methodology

Coordination between agencies and responsible parties could take many forms, including roundtable discussions, oversight committees, interagency liaisons, repurposed agencies, joint power authorities, COGs, or new entities. Improving coordination and cooperation might involve establishment of a new institutional framework, such as a systemwide, continuous, integrated group of responsible entities/agencies to oversee and coordinate flood protection, and O&M. Another method would be to establish a single entity or resource with oversight responsibilities to streamline and provide guidelines for all planning, construction, maintenance, repair, and restoration activities associated with flood management. With respect to emergency planning and response, a multi-agency coordination system could be developed for jurisdictions in the Central Valley and Delta to improve regional coordination, incident prioritization, and resource management in a major flood. Recommendations for institutional changes or practices could be developed as part of a floodplain management advisory committee composed of local and State government representatives, floodplain managers, and other stakeholders. The benefits of improved coordination could include streamlined permitting and approval processes; more efficient and cost-effective routine maintenance and repairs; more successful and sustainable environmental mitigation through regional coordination with conservation efforts; better leveraging of available funding sources; and flood management projects that provide multiple, mutual benefits.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Potential to improve efficiency and effectiveness of a broad range of flood management activities (maintenance, repairs, restoration and conservation).
- Low initial investment cost.

Disadvantages

- May require changes to the purpose or responsibilities of existing institutions.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial investment cost compared with structural measures.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to decrease O&M costs through streamlining and improving regional coordination.

Potential for Cost-Sharing?

Potential for costs to be spread across multiple agencies and jurisdictions to meet mutual goals and objectives

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to increase the efficiency and effectiveness of emergency planning, response, and recovery efforts.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Decrease. Potential to improve the cost-effectiveness of flood fighting by increasing efficiency and reducing overlapping.

Effect on Damage to Critical Infrastructure?

No direct effects.

Effect on Floodplain and Economic Development?

No direct effects.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change. However, improving coordination could indirectly facilitate more effective O&M and timely implementation projects to decrease flood liabilities.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

No direct effects; however, improved coordination could foster integration of mitigation, restoration, and conservation activities across multiple agencies and jurisdictions, resulting in more successful rehabilitation of ecosystem functions (consolidating mitigation efforts within regions, implementing mitigation in advance of impacts, and selecting more suitable lands for mitigation).

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Potential to improve the efficiency and effectiveness of mitigation associated with flood system maintenance and repairs.

Social Considerations

Contribution to Public Safety?

No direct effects; however, improved coordination would indirectly improve public safety by facilitating more efficient, cost effective, and timely operation, maintenance, and repair activities and new project implementation.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Coordination across agencies and jurisdictions could promote multi-benefit projects that meet mutual goals and objectives.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

May be difficult to sustain coordination over the long-term; individual agencies may be unwilling or unable to participate due to cost or governance structure.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

No direct effects. However, greater coordination of floodplain management activities would reduce residual risk.

Climate Change Adaptability

Potential to enhance biological adaptability by increasing the connectivity and complexity of mitigation habitats, and their continuity along environmental gradients, thus, increasing the ability of species to adjust to the consequences of climate change.

Develop and implement State criteria and processes for urban flood protection

ID MA-058

Description

Problem

State law enacted in 2007 (Senate Bill [SB] 5) calls for urban and urbanizing areas in the Sacramento-San Joaquin Valley to achieve a minimum of 200-year (0.5-percent annual chance) flood protection by 2025. However, the necessary set of criteria does not exist for evaluating whether existing or new levees are consistent with this urban level of protection. SB 5 requires that the urban level of flood protection be consistent with criteria used or developed by DWR. To avoid delaying urgently needed flood protection, California needs interim levee design criteria that fulfill this requirement until the criteria are revised by DWR and/or adopted as regulations. DWR reviewed current guidance and levee criteria by USACE and FEMA. With the exception of hydrologic, hydraulic, and levee freeboard requirements, FEMA's levee design guidance contains no specific criteria and suggests use of various USACE documents. The USACE has developed most of the guidance needed for engineers to design levee systems, and most engineers involved in levee design and construction utilize that guidance. However, some important aspects of the USACE's guidance lack specificity, need to be modified, or are still under development including criteria for frequently loaded levees and seismic vulnerability. A robust set of criteria for evaluating existing and new levees is needed for California that reflects new advances in geotechnical evaluation and exploration. This criteria would be generally consistent with USACE standards. Furthermore, there are no procedural criteria that would be applicable for engineers, cities, or counties in making a finding that the urban level of flood protection exists for an area. Due to the changing state of practice and the absence of specific guidance from the federal government on some levee design considerations, the State needs to provide interim guidance and criteria for design water surface elevations and levee design that will be used for: (1) evaluations of project levees in urban and urbanizing areas; (2) evaluations of urban and urbanizing area levees that are not part of the State-federal flood protection system (e.g., non-project levees); (3) guidance for urban and urbanizing area levee designs to be initiated/completed in the near future; (4) eligibility criteria for urban Early Implementation Program (EIP) grant funding; (5) assisting local agencies in achieving FEMA 100-year flood protection; (6) assisting local agencies in achieving the urban level of flood protection; and (7) planning studies, such as the CVFPP.

Desired Outcome

Robust and well-accepted design and procedural criteria for urban and urbanizing areas.

Methodology

DWR must develop both (1) levee evaluation and design criteria, and (2) procedures and guidance that will allow urban and urbanizing areas to meet the requirements of SB 5.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retain for further consideration.

Advantages

- Promotes consistency in how levels of protection are measured.
- Improved design criteria could improve reliability of levee performance.

Disadvantages

- May increase implementation cost of future flood improvement projects.

Economic Considerations

Capital Cost? (High, Medium, Low)

Development requires low capital costs. However, will increase implementation cost of future flood improvement projects.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Development has no direct impact on O&M costs, although implementation would potentially increase O&M costs.

Potential for Cost-Sharing?

The USACE may cost share projects that use DWR criteria.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Implementation may reduce the frequency of flooding, thereby reducing the long-term costs of emergency response and recovery. However, it would not necessarily decrease the consequences.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Implementation reduces the long-term costs of flood fighting.

Effect on Damage to Critical Infrastructure?

May reduce damage to critical infrastructure due to improved performance reliability of flood protection features.

Effect on Floodplain and Economic Development?

May support or encourage floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Implementation improves reliability of flood protection facilities; thereby reducing long-term State financial responsibility for flood recovery.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Implementation results in additional modifications to the system, which may have positive and/or adverse environmental impact.

Permitting Considerations?

Implementation will result in further modifications to the system, which may require additional permits.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Implementation will improve public safety by improving levee performance and potentially reducing the frequency of flooding in urban and urbanizing areas.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High likelihood due to SB5; should have broad agreement from technical stakeholders.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None. Redirected hydraulic impacts are associated with specific implementation of system modifications.

Effect on Residual Risk?

May reduce residual risk to existing urban areas. However, may increase consequence of flooding and overall risk, if floodplain development is encouraged (e.g., urbanizing areas).

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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Develop and implement flood protection criteria outside urban areas

ID MA-084

Description

Problem

SB 5 addresses urban and urbanizing areas, including development of levee design criteria and required levels of protection. SB 5 does not address nonurban areas where different design criteria and levels of protection may be appropriate. However, local jurisdictions in nonurbanized areas are required to continue demonstrating that they have flood protection equal to or greater than the FEMA standard of flood protection in nonurbanized areas for property located within a flood hazard zone, intended to be protected by the SPFC. Therefore, there is a need to develop flood protection criteria outside the urban areas consistent with FEMA standards.

Desired Outcome

Robust and well-accepted design and procedural criteria for nonurbanized areas, consistent with FEMA standards.

Methodology

DWR must develop both (1) levee evaluation and design criteria, and (2) procedures and guidance that will allow nonurbanized areas to meet the FEMA standards of flood protection for nonurbanized areas.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retain for further consideration.

Advantages

- Promotes consistency in how levels of protection are measured.
- Improved design criteria could improve reliability of levee performance.

Disadvantages

- May increase implementation cost of future flood improvement projects.

- Adds another layer of design over the FEMA requirements, which already apply to any FIRM designated flood plain/floodway.

Economic Considerations

Capital Cost? (High, Medium, Low)

Development requires low capital costs. However, will increase implementation cost of future flood improvement projects.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Development would cause no changes to O&M costs, although implementation would potentially increase O&M costs.

Potential for Cost-Sharing?

The USACE may cost share projects that use DWR criteria.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Implementation may decrease the frequency of flooding, thereby reducing the long-term costs of emergency response and recovery. However, it would not necessarily decrease the consequences.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Implementation decreases the long-term costs of flood fighting.

Effect on Damage to Critical Infrastructure?

May reduce damage to critical infrastructure due to improved performance reliability of flood protection features.

Effect on Floodplain and Economic Development?

May support or encourage floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Implementation improves reliability of flood protection facilities; thereby decreasing long-term State financial responsibility for flood recovery.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

Implementation results in additional modifications to the system, which may have positive and/or adverse environmental impact.

Permitting Considerations?

Implementation will result in further modifications to the system, which may require additional permits.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

Implementation will improve public safety by improving levee performance and potentially reducing the frequency of flooding in nonurbanized areas.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Likely to have broad agreement from technical stakeholders.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None. Redirected hydraulic impacts are associated with specific implementation of system modifications.

Effect on Residual Risk?

May reduce residual risk to existing nonurban areas. However, may increase consequence of flooding and overall risk if floodplain development is encouraged (e.g., urbanizing areas).

Climate Change Adaptability

This action is unrelated to hydrologic and biological adaptability.

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Update State Title 23 standards

ID MA-085

Description

Problem

Title 23 of the California Code of Regulations (CCR) is the overall regulatory framework in California that gives the Central Valley Flood Protection Board (Board) authority to enforce standards for the erection and O&M of levees, channels, and other flood control works, along the Sacramento and San Joaquin rivers and their tributaries, including, but not limited to standards for encroachments, construction, vegetation, and erosion control. There are concerns that the existing Title 23 does not adequately reflect the current understanding of the relative risk posed by the different factors to the integrity of the flood management system (e.g., levee penetrations, riparian plantings in the floodway).

Desired Outcome

Updated Title 23 standards that reflect the current understanding of system integrity factors.

Methodology

Review current and proposed flood management related criteria, policies, and practices and revise Title 23 accordingly. Title 23 should be updated to incorporate changes resulting from SB 5.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Would improve efficiency and effectiveness of oversight and enforcement.
- Would reduce implementation barriers for ecosystem restoration projects.

Disadvantages

- The process of updating Title 23 could be lengthy, and will require broad legislative support.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Measures put in place consist of policies, plans, and improved tools; they do not involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

None.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No significant change directly resulting from Title 23 revision, but could indirectly decrease State responsibility by prioritizing the focus on higher risk factors.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Potential to reduce implementation barriers to ecosystem restoration projects within the flood management system and the designated floodway.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

The permitting of a Title 23 update could be extensive, and will require broad legislative support.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Potential to reduce the conflict between maintenance and repairs requirements and habitat management in the flood management system.

Social Considerations

Contribution to Public Safety?

Potential to improve reliability and integrity of the flood management system by prioritizing the focus on higher risk factors.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Would require broad State/legislative support.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Clarify flood management responsibilities for all local, regional, State, and federal agencies

ID MA-086

Description

Problem

The State is responsible for maintaining conveyance capacity within the channel, and local maintaining agencies are responsible for levee maintenance beyond the waterside levee toe. In areas where there erosion has made it difficult to determine the limits of levee/channel, responsibilities for O&M, and repair are difficult to determine. Many federal project levees or recently strengthened levees have documented geometry and limits. Determination of responsibility is more of a problem in nonurban areas where there is limited documentation.

Desired Outcome

A clear method for determining the responsibility of flood management for all local, regional, State, and federal agencies.

Methodology

To clarify limits of responsibility, State and federal agencies will have to work with local agencies to review existing flood control systems, develop an understanding of typical levee/floodway geometry, and identify a method to consistently estimate (as constructed) channel and levee limits.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Reduce institutional barriers to O&M activities.

Disadvantages

- Limited (or no) documentation on design or construction of older levees.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low capital costs. Measures to be put in place consist of policies, plans, and improved tools, and they do not involve physical construction.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

This action would not impact the cost of O&M, but could impact the allocation of cost/responsibility.

Potential for Cost-Sharing?

None.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

None.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to shift (increase or decrease) existing State O&M responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impact?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

High level of support by maintaining agencies.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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10.0 Permitting

MA-054: Develop regional and river-corridor conservation plans, or expand existing regional conservation plans (e.g., regional Habitat Conservation Plans and Natural Community Conservation Plans) to provide a more efficient and effective regulatory approval process for flood projects

MA-055: Develop regional advanced mitigation strategies and promote networks of both public and private mitigation banks to meet the needs of flood and other public infrastructure projects

MA-056: Develop proactive integrated regulatory compliance strategies that streamlines permitting activities

MA-100: Establish memoranda of understanding and/or management agreements between agencies to integrate the needs to be served by the flood control system

MA-101: Provide technical assistance and education on environmental permits

MA-102: Develop and implement Corridor Management Strategy

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Develop regional and river-corridor conservation plans, or expand existing regional conservation plans (e.g., regional Habitat Conservation Plans and Natural Community Conservation Plans) to provide a more efficient and effective regulatory approval process for flood projects

ID MA-054

Description

Problem

Habitat and ecosystem planning is conducted in a piecemeal, fragmented fashion in many parts of the planning area. Multiple regulatory agencies are responsible for ensuring the protection or mitigation of environmental resources impacted by flood management activities. Limited coordination and shared vision results in a regulatory approval process that adds complexity and scheduling challenges to flood project approvals. It also results in fragmented conservation projects that may have limited viability in terms of long-term biological success.

Desired Outcome

A more efficient and effective regulatory approval process for flood projects process and improved long-term habitat through high-quality regional and river-corridor conservation plans.

Methodology

Develop plans to provide measurable biological objectives for targeted resources, incorporate adaptive management approaches, fund long-term habitat management and monitoring, and provide the public with the opportunity to assess, review, and critique plans as they are being developed.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other management actions involving ecosystem restoration, agency coordination, and land use planning.

- Habitat planning and mitigation requirements have been developed ahead of projects.
- Conservation plans tend to streamline the permitting process in general.
- If the land is held by public agency, it is exempt from local tax rolls and is taken out of production
- Direct mitigation to larger projects of greater ecological value and lower per unit cost.
- Lands improved or restored could be available for public recreation.

Disadvantages

- Difficulty in completing Habitat Conservation Plans.
- High risk of not completing.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium . Plans such as NCCPs require adequate funding to develop. Implementation of the plans, which constitute other management actions, will have varying capital costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Little change. Plans require some minimal annual administrative funding to ensure good communication among partners and to develop adaptive solutions to changed or unforeseen circumstances, but this cost can be offset by cost-savings associated with more efficient implementation.

Potential for Cost-Sharing?

High potential for cost-sharing among various agencies with responsibilities for ecosystem planning and flood system operations and maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Improved regional coordination will likely have no major change on emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Improved regional coordination will likely have no major change on flood fighting costs.

Effect on Damage to Critical Infrastructure?

Improved regional coordination will likely have no major effect on damage to critical public infrastructure.

Effect on Floodplain and Economic Development?

Regional conservation plans will help to direct land development projects toward areas where they will have the least impact on both flood management and habitat conservation goals.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Improved regional coordination will likely have no major negative effect on State flood responsibility. More effective regional coordination between agencies could improve the ability to meet our flood responsibilities.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Increased regional collaboration among habitat and ecosystem planning and mitigation would result in rehabilitation of ecosystem functions by concentrating mitigation in larger areas, and by selecting more suitable lands for mitigation than is possible with piecemeal mitigation.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Improved and streamlined permitting for future projects.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations

Contribution to Public Safety?

This management action is not likely to directly affect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Conservation plans provide opportunities to improve water quality, increase open space, and manage recreation in ways that are compatible with overall CVFPP goals.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

California has over 30 regional conservation plans in varying stages, with some plans in the implementation phase for over 10 years. Corridor management plans are under development, and they are being viewed as valuable approaches for meeting multiple flood management goals on specific reaches.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Actions within the flood zone will result in a hydraulic impact.

Effect on Residual Risk?

None.

Climate Change Adaptability

This action would enhance biological adaptability by increasing the effectiveness of conservation actions for enhancing the ability of populations to handle and adjust to the consequences of climate change by increasing the extent, connectivity, complexity, and continuity of habitats across environmental gradients, which would increase the size and viability of populations. Many existing conservation plans currently are incorporating climate change as part of their long-term objectives.

Develop regional advanced mitigation strategies and promote networks of both public and private mitigation banks to meet the needs of flood and other public infrastructure projects

ID MA-055

Description

Problem

Although many flood projects can avoid or greatly reduce their impacts to habitat, some projects require offsite mitigation to compensate for habitat losses. Identifying suitable offsite locations is often left to the last phase of flood projects, as it becomes more evident about the extent and nature of the expected impact. Regulatory agencies need to approve these offsite locations, and negotiations can delay overall flood project approvals. A second problem is the temporal loss of habitat, which occurs between the time when the flood project removes habitat and the time when compensatory habitat is restored to pre-project levels. A third problem is that offsite locations comparable in area to the impact are often too small and isolated to have long-term viability. To remain viable in perpetuity, as required, such small areas often require high ongoing maintenance costs. Lastly, generating funding sources for mitigation early in the planning stages instead of later when the project begins construction is an obstacle.

Desired Outcome

High quality regional advance mitigation strategies and networks of mitigation banks that meet the needs of flood and other public infrastructure projects.

Methodology

Develop supporting State and federal policies, and sustainable funding sources within the State and federal budgets, and develop partnerships with regulatory agencies for planning and implementation of comprehensive regional advance mitigation banks.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Will work well in conjunction with other management actions involving ecosystem restoration, agency coordination, and land use planning.
- Could accelerate permitting of flood system projects because of early identification of mitigation.
- Directs mitigation to larger projects of greater ecological value and could result in lower per unit cost versus project-by-project mitigation.

Disadvantages

- Does not directly improve reduce flood risk management.
- Could motivate project applicants to be careless about impact avoidance because the method to mitigate would become less cumbersome
- If mitigation program focuses on a single large site, it may miss aiding a specialized threatened or endangered species or not meet all its specific needs
- Often lacking is the project specific knowledge needed to allow for strategic placement of regional advance mitigation sites close to the impact.

Economic Considerations

Capital Cost? (High, Medium, Low)

High. Establishment of mitigation banks requires acquisition of land, permitting, restoration, and funding for long-term management and monitoring.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Regional collaboration for advance mitigation banks is likely to decrease overall costs of regulatory compliance and mitigation for operations, maintenance, and repair activities.

Potential for Cost-Sharing?

High potential for cost-sharing among various agencies with responsibilities for large infrastructure projects, ecosystem planning and flood system operations and maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Developing regional mitigation banks will likely have no major change on emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Developing regional mitigation banks will likely have no major change on flood fighting costs.

Effect on Damage to Critical Infrastructure?

Developing regional mitigation banks will likely have no major change on damages to public infrastructure.

Effect on Floodplain and Economic Development?

Implementation of advance mitigation banks may reduce the floodplain area available for future development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Implementation of advance mitigation banks will likely have no significant negative effect on State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Implementation and coordination on regional advance mitigation planning would result in rehabilitation of ecosystem functions by concentrating mitigation in larger areas, by implementing mitigation in advance of impacts, and by selecting more suitable lands for mitigation than is possible with piecemeal mitigation.

Potential for Adverse Environmental Impacts?

Banks should be placed to avoid secondary impacts such as conversion of prime farmland or soil containment releases to the water column (e.g., from mercury).

Permitting Considerations?

Improved and streamlined permitting for future infrastructure projects. Banking has a complex set of permitting requirements and it will take extensive work to create credits that can be used for flood projects.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations

Contribution to Public Safety?

This management action is not likely to directly affect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Regional advance mitigation banks will increase open space. Wetlands created in mitigation banks can yield water quality improvements.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

There is high interest in developing regional advance mitigation banks from infrastructure agencies, resource agencies, and conservation organizations. Private mitigation banks already exist and regulatory agencies have developed standard approval processes for establishing these banks.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

Depending on placement, advanced mitigation sites could redirect the hydrology and cause secondary impacts.

Effect on Residual Risk?

None.

Climate Change Adaptability

This action would enhance biological adaptability by increasing the effectiveness of conservation actions for enhancing the ability of populations to handle and adjust to the consequences of climate change by increasing the extent, connectivity, complexity, and continuity of habitats across environmental gradients, which would increase the size and viability of populations.

Develop proactive integrated regulatory compliance strategies that streamlines permitting activities

ID MA-056

Description

Problem

Numerous permits are required to conduct regular maintenance activities on the State-federal flood protection works for routine maintenance, restoration, enhancement, and other activities. Challenges associated with permitting include the costs associated with documentation and mitigation, length of the process, restrictive conditions, and conflicting State and federal priorities. Furthermore, limited construction work windows, uncertainty regarding which permits are required for routine maintenance, and limited coordination among the various entities issuing permits had resulted in the deferral of important maintenance activities. Many maintaining agencies have limited staff resources and funding, and have expressed concern over the amount of their operating budgets that are dedicated to obtaining permits to perform required maintenance. This situation creates regulatory uncertainty for the State, maintaining agencies, and regulatory agencies.

Desired Outcome

A regulatory compliance strategy (such as developed for the Small Erosion Repair Program), that standardizes and streamlines the permitting process (timeliness and efficiency), reduces costs, and promotes regional efforts that support more successful mitigation to improve public safety, reliable water supply, and ecosystem function.

Methodology

The permitting process needs to be developed to facilitate the necessary permitting for maintenance work, and restoration and enhancement actions. This will preserve design flow and levee integrity while enhancing environmental resources, through coordination, collaboration, and cooperative working relationships with all stakeholders and interested parties. This process should identify where environmental clearance and permitting processes can be made more efficient while still meeting State and federal safety standards and following State and federal environmental protection procedures. Below are some options:

1. Increasing the duration over which the permits are valid to reduce costs and to promote more proactive maintenance (particularly in areas or locations that require more frequent maintenance). Various agencies, including the DFG, USACE, and the Central Valley Regional Water Board, already encourage or have mechanisms for multi-year permits for routine activities. However, local maintaining agencies are often unaware of these options or have difficulty funding the up-front costs required to obtain longer duration permits. For example, a new USACE regional permit could be created or Letters of Permission

(LOP) issued for O&M activities to be renewed every 5 years in concert with other State or federal permits.

2. Establishing an interagency permitting office or clearinghouse could help improve the review, frequency of inspection, and enforcement of encroachment permits and permit violations to ensure consistency with system objectives while enhancing local compliance.

3. Providing habitat restoration above and beyond what is necessary for project impacts could assist in streamlining future mitigation needs, as would developing and implementing a Regional Advanced Mitigation Program (RAMP) that forecasts mitigation needs for routine maintenance and other project impacts and provides the necessary mitigation in advance of the need. Collaboration of all permitting agencies in the RAMP could ensure permit streamlining. A key to the success of any effort to streamline permitting for maintenance would be the establishment of a consistent, widely recognized definition of "routine maintenance" and the activities associated with maintenance. Knowing how routine maintenance actions can avoid and minimize impacts is also necessary. This may be explored at a regional or valley-wide level in coordination with local, State, and federal permitting agencies. Once the definition is established, regulations may need to be modified or new regional permitting processes created to support timely and effective implementation of required maintenance activities.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low O&M costs.
- Initial costs for permitting and mitigation could be high, but mitigation and permitting costs may decrease in the long-run.

Disadvantages

- Requires coordination among State, federal, and local agencies.

- State leadership required. May require coordination from various agencies for system wide projects, or regional projects that cross jurisdictions.
- Permits expire; limits long-term approach.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low; policy actions will tend to have a substantially lower capital cost than actions involving physical construction. If land is purchased for mitigation, initial costs could be high.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

A streamlined permitting process has the potential to reduce long-term maintenance and repair costs. This process can allow for more swift repairs before sites become larger, which is less costly, and better for the environment and public safety. However, upfront mitigation costs may be high.

Potential for Cost-Sharing?

Cost to implement could be shared among various local, State, and federal agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Would decrease emergency cost by allowing for more maintenance work to be accomplished and reduce the impact of emergency efforts greatly over the entire system.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Once implemented would allow for more maintenance work to be accomplished and reduce the impact of flood flows greatly over the entire system.

Effect on Damage to Critical Infrastructure?

Once implemented would allow for more maintenance work to be accomplished and would reduce the impact of flood flows impact on infrastructure greatly over the entire system.

Effect on Floodplain and Economic Development?

As existing floodplains will most likely provide the lands needed for new habitat, establishing large areas as mitigation banks for future projects could preclude the ability for urban development within the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

If development cannot occur in the floodplain due to the establishment of conservation or mitigation banks, then the State's flood responsibility cannot increase in the future.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Implementing proactive compliance strategies can address larger scale environmental impact avoidance and opportunities to enhance the environment. It could allow for rehabilitation of ecological functions, by implementing mitigation in larger consolidated areas, in advance of impacts, and in more suitable areas than with piecemeal mitigation.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Requires changes to existing policies and procedures. A reduction in the number of permits could result in the reduction in workload of permitting agencies. Regional general permits are tough to get. Good to get lots of people together to get a regional perspective.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and mitigation better coordinated.

Social Considerations

Contribution to Public Safety?

Promotes consistent and sustainable operations and maintenance of the flood protection work and thereby reduces the risk of floods.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Developing large scale compliance efforts provide opportunities to improve water quality, increase open space, and manage recreation in ways that are compatible with overall CVFPP goals.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Initial development of a new permitting strategy would require intense coordination and commitment by multiple agencies; however, once streamlined and/or programmatic permitting mechanisms are established, flood system maintenance activities would be more timely and cost-effective for all parties involved.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

A streamlined process is likely to preserve maintenance funds for maintenance, not redirecting them for permitting costs. The net result is a more reliable and better maintained levee. Regular and consistent maintenance of levees and channels will improve the response of the flood protection works and thereby lower systemic risks of flooding.

Climate Change Adaptability

Would indirectly contribute to climate change adaptability by encouraging or facilitation more successful and sustainable mitigation. In 2008 DWR published a white paper: Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water in which they identified 10 strategies designed to improve California's ability to cope with a changing climate. Strategy #5 is to enhance and sustain ecosystems. Restoration of floodplain habitats, riverine habitats and riparian habitats will directly improve the amount of carbon sequestration and assist DWR in realizing this goal.

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Establish memoranda of understanding and/or management agreements between agencies to integrate the needs to be served by the flood control system

ID MA-100

Description

Problem

Flood control system features encompass critical habitat and migration corridors for many listed and endangered species, and remaining riparian vegetation represents a small percent of what historically existed. Opportunities exist within the flood control system for mitigation and restoration; however, obtaining permits and clearances for repair, replacement, and ongoing maintenance of flood control system features is a costly, complicated and lengthy process. Furthermore, it will be a disincentive if the permitting and mitigation burden the flood control system maintenance and the risk of liability for incidental take increases due to species recovery from mitigation and restoration efforts in the flood control system.

Desired Outcome

An efficient, collaborative interagency approach that acknowledges the prime purpose of the flood control system as public safety, while providing the appropriate assurances and process to allow for mitigation and restoration efforts within the flood control system, managed in concurrence with ongoing operations and maintenance for flood management and water supply.

Methodology

Use interagency memoranda of understanding (MOU) and management agreements, such as those used for the Yolo Basin Wetland Project (YBWP), to provide the assurances and processes needed to enable mitigation and restoration opportunities in the project to be realized, while providing for effective management for water supply, flood control and habitat. In the YBWP, a MOU was entered into by the Board , DWR, DFG, and the U.S. Fish and Wildlife Service (USFWS) acknowledging, among other items, the following: the USACE was preparing an O&M manual for the flood control system modification creating the restoration area; the primary purpose of the Yolo Bypass is for flood control; ongoing maintenance to that end would have impacts, and it was not expected to have long-term adverse impacts on the species in question; and the project modification, including ongoing management under the O&M manual, would provide a net benefit for the environment and species that could become established in the area. DFG took over management of the area. A management agreement addressing day-to-day management of the area was entered into by DWR, DFG, and the Board. Later, the agreement, via letter from the Board, requesting signed concurrence from the other agencies, was expanded to other areas.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Approach supports managing corridors in an efficient, sustainable and integrated manner, providing environmental benefits and supporting public safety.
- Could provide mitigation DWR will need for other efforts.
- Could preserve/enhance some of the last remaining riparian and wetland habitat communities in the State.

Disadvantages

- Up front time and cost for pre-planning and to execute the agreements.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial investment cost compared with structural measures.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Potential to decrease O&M costs through streamlining and improving regional coordination.

Potential for Cost-Sharing?

Potential for costs to be spread across multiple agencies and jurisdictions to meet mutual goals and objectives.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Potential to increase the efficiency and effectiveness of emergency planning, response, and recovery efforts.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Potential to improve the cost-effectiveness of flood fighting by increasing efficiency and reducing overlapping.

Effect on Damage to Critical Infrastructure?

No direct effects.

Effect on Floodplain and Economic Development?

Efforts like this MOU can help to define and guide the responsible use and management of the floodplain.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No direct effects, but improving coordination could indirectly facilitate more effective O&M and timely implementation projects to reduce flood liabilities.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

No direct effects; however, improved coordination could foster integration of mitigation, restoration, and conservation activities across multiple agencies and jurisdictions, resulting in more successful rehabilitation of ecosystem functions (consolidating mitigation efforts within regions, implementing mitigation in advance of impacts, and selecting more suitable lands for mitigation).

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Improved and streamlined permitting processes, including long-term agreements and authorizations for future efforts.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Potential to improve management of the flood control system through agreements that provide for maintenance capabilities that encouraging sustainable habitat communities within the flood control system.

Social Considerations

Contribution to Public Safety?

No direct effects. However, improved coordination would indirectly improve public safety by facilitating more efficient, cost effective, and timely O&M and new project implementation.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

MOUs with various agencies and jurisdictions could promote multi-benefit projects that meet mutual goals and objectives.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

May be difficult to initially develop the MOUs.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

No direct effects.

Effect on Residual Risk?

No direct effects. However, greater coordination of floodplain management activities would reduce residual risk.

Climate Change Adaptability

Potential to enhance biological adaptability by increasing the connectivity and complexity of mitigation habitats, and their continuity along environmental gradients, thus, increasing the ability of species to adjust to the consequences of climate change.

Provide technical assistance and education on environmental permits

ID MA-101

Description

Problem

Applying for and obtaining environmental and other permits for construction and O&M activities can be a complex and arduous process.

Desired Outcome

Literature describing and promoting greater understanding of what permits are required, what the permitting agencies require to issue these permits, and the timelines associated with these permits.

Methodology

A permit workbook will be developed that will include a description of the relevant permits, permit applications, and permitting guidance for each of the regulatory agencies. Applicable laws and regulations include, but are not limited to, Section 404 of the Clean Water Act (CWA), Section 10 of the Rivers and Harbors Act, Section 401 of the CWA, Section 1602 and 1603 of the DFG Code, Endangered Species Act, California Endangered Species Act, California Environmental Quality Act, and the Section 106 of the National Historic Preservation Act. The permit workbook will be distributed and training workshops scheduled.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Promotes awareness of the required environmental permits.
- Education can help facilitate the permitting process.
- Education can help prevent non-permitted actions from occurring.

Disadvantages

- Up front time and cost.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial investment cost compared with structural measures.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Technical assistance and education on environmental permits will likely have no significant change on annual cost to operate/maintain/repair.

Potential for Cost-Sharing?

High potential for cost sharing among various agencies.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Technical assistance and education on environmental permits will likely have no significant change on emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

None.

Effect on Floodplain and Economic Development?

Technical assistance and education on environmental permits will likely have no significant negative effect on floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Technical assistance and education on environmental permits will likely have no significant negative effect on State flood responsibility.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Technical assistance and education on environmental permits could have a positive impact on physical processes and ecological functions.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Technical assistance and education on environmental permits can help facilitate the permitting process.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Technical assistance and education on environmental permits can help prevent non-permitted actions from occurring.

Social Considerations

Contribution to Public Safety?

This management action is not likely to directly affect public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Technical assistance and education on environmental permits is not likely to provide benefits to water supply, recreation or open space.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Technical assistance and education on environmental permits is anticipated to be well received and therefore, the likelihood of implementation is high.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Develop and implement Corridor Management Strategy

ID MA-102

Description

Problem

Obtaining permits and clearances for repair, replacement, and ongoing maintenance of SPFC features is a costly, complicated, and lengthy process; SPFC features encompass critical habitat and migration corridors for many listed and endangered species, and remaining riparian vegetation represents a small percent of what historically existed. The State-federal flood protection system in the Central Valley represents, as a whole, an antiquated system that is being asked to serve needs not contemplated when its structures, levees, and channels were built, and when they were cobbled together over 50 years ago to form the SPFC. Further, legacy issues exist in design and construction; some SPFC features have passed or are nearing the end of their design life. A new approach in managing the SPFC is required if today's needs are to be served.

Desired Outcome

An effective and sustainable water management system through integration of public safety, water supply, and ecosystem function.

Methodology

Identify discrete portions of the SPFC ("corridors"); assess existing channel habitat and geomorphology and identify how the channel could be better managed in terms of public safety, water supply, and ecological function; and develop long-term management plans for these corridors (including a prioritized list of needed repairs and/or new construction; areas identified for ecosystem restoration opportunities; a long-term routine maintenance plan; permits and clearances for nearer term repair/construction and routine maintenance (long term); performance measures for public safety, water supply and the ecosystem; a monitoring and reporting plan evaluating success in meeting performance measures); and an adaptive management plan. Modifications to the corridor and ongoing maintenance will be designed to manage for flow (peak for public safety, and non-peak for reliability in water supply) and improved ecosystem function. SPFC proponents, along with State, federal, and local permitting agencies, local maintaining agencies, and representatives from local communities served by the corridor, should all be a part of the process when corridor management plans are developed, so the critical needs of all entities either responsible for, or served by, the corridor can be considered in the process and appropriate solutions designed to address the various needs, system performance criteria, and permitting requirements.

Contributes Significantly to CVFPP Goal

- Improve Operations and Maintenance

Potentially Contributes to CVFPP Goal(s)

- Improve Flood Risk Management
- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support
- Promote Multi-Benefit Projects

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Approach supports managing corridors in a sustainable and integrated manner, serving multiple needs.
- Permitting time and cost lower in long-term.
- Long-term permitting for maintenance can allow for more swift repairs before sites become larger, which is less costly, and better for the environment and public safety.
- Ongoing monitoring and reporting to evaluate success in meeting performance measures will support adaptive management of the system.

Disadvantages

- Increased upfront cost for pre-planning.
- Communication with multiple groups with diverse interests will be required for success.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium. CMPs require adequate funding to develop. Implementation of the plans, which constitute other management actions, will have varying capital costs.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Decrease. Long-term management plans for maintenance can allow for more swift repairs before sites become larger, which is less costly, and better for the environment and public safety.

Potential for Cost-Sharing?

High potential for cost sharing among various agencies with responsibilities for ecosystem planning and flood system operations and maintenance.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Would decrease emergency cost through more proactive integrated efforts that define processes and responses during emergency situations by allowing for more for more maintenance work to be accomplished and reduce the impact of emergency efforts significantly over the entire system.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Once implemented would allow for more maintenance work to be accomplished and reduce the impact of flood flows significantly over the entire system.

Effect on Damage to Critical Infrastructure?

Once implemented would allow for more maintenance work to be accomplished and greater opportunity to swiftly respond to maintenance needs, thereby reducing the impact of flood flows impact on infrastructure significantly over the entire system.

Effect on Floodplain and Economic Development?

CMS will help to direct land development projects toward areas where they will have the least impact on both flood management and habitat conservation goals.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

CMS will likely have no significant negative effect on State flood responsibility. More effective coordination between agencies could improve the ability to meet our flood responsibilities.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Use of long-term plans could allow for mitigation that allows for enhancement of corridors for improved ecological functions by implementing mitigation in larger consolidated areas, in advance of impacts, and in more suitable areas than with piecemeal mitigation.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Improved and expedited permitting for future projects.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

Impacts associated with flood system O&M could be reduced because O&M would be better facilitated and avoidance measures or mitigation efforts better coordinated.

Social Considerations

Contribution to Public Safety?

Promotes consistent and sustainable operations and maintenance of the flood protection work and thereby reduces the risk of floods.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

A CMS could provide opportunities to improve water quality, increase open space, and manage recreation in ways that are compatible with the overall CVFPP goals.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Other strategies are being developed and they are being viewed as valuable approaches for providing multiple benefits on specific reaches including flood management and improved ecosystem function.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

Improved maintenance capability through a CMS could provide for maintaining or increasing capacities within the river corridor to allow for expected increase in runoff and flow due to climate change.

11.0 Finance and Revenue

MA-059: Maximize funding for flood management projects by leveraging federal funding

MA-060: Leverage funding from multiple projects to improve cost- effectiveness and efficiency of flood management projects

MA-062: Develop funding mechanisms for O&M and new flood management improvements

MA-096: Establish a methodology for evaluating benefits and costs on a systemwide basis to support economic justification for projects in all community settings

MA-098: Create a shared strategic pooled money account that pre-funds avoidance/mitigation solutions for O&M impacts on current and future flood facilities

MA-099: Create a strategic pooled money account that provides funds for land stewardship activities at current and future flood-related mitigation areas in perpetuity

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Maximize funding for flood management projects by leveraging federal funding

ID MA-059

Description

Problem

Current local, State, and federal funding mechanisms are not adequate to sustain effective flood management.

Desired Outcome

Maximized available funding for flood management projects.

Methodology

Projects could be planned and developed specifically to leverage funding from multiple federal sources, including the FEMA, NFIP, USFWS, U.S. Department of the Interior, Bureau of Reclamation, U.S. Environmental Protection Agency, and the USACE. This might include development of multi-benefit projects that leverage funding for a variety of federal project purposes (flood risk reduction, environmental restoration, hazard mitigation, water supply, water quality, recreation, hydropower, and others), or development of projects that incorporate both structural and nonstructural actions addressing flood risk reduction as well as mitigation once flooding occurs.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low cost to implement for the potential benefits gained.
- More federal funding could reduce the impact on level of State funding necessary to carry out the necessary flood projects.
- Ability to leverage additional benefits (other than just flood control).
- Little to no cost or risk.
- Potential for projects to “self-mitigate”, reducing regulatory (permitting) time and effort.
- Potential for a continuous, reliable funding mechanism for flood system maintenance.

Disadvantages

- Federal cost-sharing percentage for flood management has decreased over the past decade.
- May require changes to federal cost-sharing laws or appropriations to realize significant benefits.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low cost to implement.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

Federal cost sharing has been decreased from 75 to 65% in recent years; even if projects are formulated specifically to promote federal interests, federal appropriations may remain low.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

No direct effects, but protection of public infrastructure could be improved over the long-term if more funding is made available to improve the flood management system. Faster improvement of flood management facilities would reduce the infrastructure damage.

Effect on Floodplain and Economic Development?

No direct effect, but improvements to the flood management system and level of protection provided could encourage additional floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No direct effects, provided flood management improvement projects do not expand State flood responsibilities.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

No direct effects, but increased funding for improvements (and development of sustained, reliable funding) would result in a flood management system that provides greater public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

No direct effects.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support through more efficient use of local funding; may require changes to laws or regulations at a federal level (cost sharing and/or appropriations); may require new local, State, or federal programs.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Leverage funding from multiple projects to improve cost-effectiveness and efficiency of flood management projects

ID MA-060

Description

Problem

There are often numerous projects occurring simultaneously in the same region, all of which include planning, design, permitting, and mitigation, and construction activities independent of each other. This could result in duplicate efforts, excess use of resources, and the potential for missed opportunities to provide mutual benefits.

Desired Outcome

Improved cost effectiveness and financial feasibility of individual flood management projects by consolidating projects on a regional or systemwide level.

Methodology

Align new multi-benefit projects, such as setback levees, with other existing or planned projects (such as roads, highways, or environmental restoration projects) to leverage funding from multiple agencies and jurisdictions, increase construction and maintenance efficiency, combine mitigation efforts, and accomplish multiple objectives. Consolidating and coordinating planning and design activities could increase cost effectiveness, highlight opportunities to provide mutual benefits or multiple benefits beyond those planned as part of individual projects, improve the effectiveness and sustainability of mitigation activities, and leverage funding and implementation support from multiple sources.

Contributes Significantly to CVFPP Goal:

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s):

- Improve Institutional Support

Recommendations (Retained/Not Retained):

Retained.

Advantages

- Low cost to implement for the potential benefits gained like shared data and information and eliminating duplications.
- Potential to improve cost effectiveness of improvements.
- Ability to leverage additional benefits out of projects.
- Potential for formerly single-purpose projects to "self-mitigate", reducing regulatory (permitting) time and effort.

- Projects with multiple benefits projects are much more likely to be implemented than single-purpose projects.

Disadvantages

- Will require coordination across multiple agencies and jurisdictions.
- If one aspect of a multi-purpose project is legally challenged, all components are at risk of not moving forward.
- Requirements and criteria make it difficult to partner with federal agencies.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low cost to implement.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

O&M costs could decrease with integrated projects as opposed to multiple single-purpose projects pursued in isolation.

Potential for Cost-Sharing?

Projects that provide regional benefits and address the interests of multiple partners may be more cost-effective and successful in generating funding from a variety of sources. Utilizing all various sources of data and information could reduce the cost of a study or project. The size of a project also affects USACE calculation of cost-benefit ratios.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

No direct effects on public infrastructure; however, flood management projects that incorporate improvements to transportation or other public infrastructure may provide increased funding opportunities.

Effect on Floodplain and Economic Development?

No direct effect, but improvements to the flood management system and level of protection provided could encourage additional floodplain development.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Key physical processes and ecosystem functions could be rehabilitated by combining funding requests of ecosystem restoration projects with flood management projects, increasing the likelihood for funding of both.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

No direct effects, but increased funding for improvements would result in a flood management system that provides greater public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

Integrated projects may be able to provide multiple benefits.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Potential for broad public support; would require increased coordination at State, federal, and regional levels.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Develop funding mechanisms for O&M and new flood management improvements

ID MA-062

Description

Problem

Current local and State funding mechanisms are not sufficient in many cases to adequately sustain effective flood management. Investment in flood management has declined in recent years at all levels of government. Public funds available through various State grant, loan, and bond programs have helped bridge funding gaps for many local improvement projects. However, funding for these State programs has varied over time and is limited by budget constraints and political subjectivity. Federal cost sharing for flood management projects dropped from 75 percent to 65 percent in recent years. Further, local entities are often responsible for funding large portions of projects that provide significant regional or statewide benefits (economic, social, and cultural benefits).

Desired Outcome

Sustainable funding for flood system O&M and new flood management improvements.

Methodology

There are many opportunities for funding flood management actions and improvements outside of traditional taxes, bond funding, and grants. Alternate sources of funding should be considered for flood project implementation, including non-governmental organizations, local or regional funding groups, or recreation fees. For example, there may be opportunities to collect fees from areas that share in the regional or statewide benefits provided by a robust flood management system but do not directly receive flood protection. Studies that demonstrate the nexus between public benefits and beneficiaries could assist in determining funding mechanisms and sources. Benefits should be evaluated systemwide, regionally, and for the entire State.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Sustainable funding would provide real and lasting benefits to all aspects of flood management.
- Ability to leverage additional benefits (other than just flood control).
- Little to no cost or risk.
- Potential for projects to “self-mitigate”, reducing regulatory (permitting) time and effort.

Disadvantages

- May be difficult to change laws or regulations governing revenue generation.
- Sustainable funding is a significant issue now and will continue to be so into the future.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial cost to implement

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

New or improved cost sharing mechanisms could be incorporated into this management action.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Improving O&M could contribute to a decrease in emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No direct effects; improving O&M could improve the reliability of the flood management system, indirectly reducing flood fighting.

Effect on Damage to Critical Infrastructure?

No direct effects on public infrastructure.

Effect on Floodplain and Economic Development?

No direct effect.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to decrease State flood responsibility if O&M is more cost effective.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

High potential to reduce conflicts between O&M and environmental values.

Social Considerations

Contribution to Public Safety?

No direct effects, but improving O&M could contribute to improving public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Jurisdictional and institutional roles and responsibilities would need to be established, depending on the mechanism; may require changes to existing laws or regulations governing funding and revenue generation for O&M and other flood management activities.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

No direct effects.

Climate Change Adaptability

No direct effects.

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Establish a methodology for evaluating benefits and costs on a systemwide basis to support economic justification for projects in all community settings

ID MA-096

Description

Problem

Existing criteria for determining a cost-benefit analysis of projects is very rigid. Some benefits that do not have an obvious monetary value may be excluded. In addition, if only the benefits to the immediate project area are determined, and not the benefits to the system as a whole, a project may be evaluated as having less benefits than it actually has.

Desired Outcome

Cost-benefit analyses that show benefits to both the immediate area and systemwide and that evaluate benefits that do not have an obvious monetary value.

Methodology

Develop a new set of State criteria that is more inclusive and looks at all benefits for both the immediate area and the system as a whole. Methods to determine value of benefits that do not have an obvious monetary value should be developed.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Looks at projects on a systemwide basis.
- Gives more value to areas that had traditionally been undervalued, such as agricultural areas.

Disadvantages

- Assigning a monetary value to a benefit that doesn't necessarily have an obvious monetary value can be difficult and the results may seem artificial.

Economic Considerations

Capital Cost? (High, Medium, Low)

Medium. Criteria need to be developed and training needs to take place before cost-benefit analysis can begin.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No change.

Potential for Cost-Sharing?

State and local cost sharing opportunities.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No change.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No change.

Effect on Damage to Critical Infrastructure?

None.

Effect on Floodplain and Economic Development?

None.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to increase State flood responsibility if more projects are completed ,due to new criteria.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

None.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

This management action would have a lot of support from communities that feel like they have traditionally been undervalued.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Create a shared strategic pooled money account that pre-funds avoidance/mitigation solutions for O&M impacts on current and future flood facilities

ID MA-098

Description

Problem

Lack of funding can curtail effective environmental mitigation for routine O&M of the flood management system. One view holds that the current process for obtaining permits and mitigating potential O&M impacts can exceed the budgets and resources of some maintaining agencies. Most maintaining agencies have limited funding sources and some have expressed that they are spending an increasingly larger portion of their operating budget and time obtaining permits, often involving coordination with multiple agencies, to perform required maintenance activities. Others contend that traditional O&M funding mechanisms were established during a time when maintenance activities were less sensitive to environmental impacts and did not consider the costs associated with O&M today. The concept of sustainable and equitable funding for flood protection system O&M in perpetuity is very important. Currently, there are many shapes and sizes of maintaining agencies. Each entity has its own challenges in obtaining funding.

Desired Outcome

Improved efficiency and cost-effectiveness of flood system O&M and associated mitigation.

Methodology

When cost estimating is completed for a repair project or ongoing O&M activity, sufficient funds should be set aside for environmental mitigation. Funding and consultation for mitigation and O&M activities could be combined if planned in the early stages of a project. Creating a shared bank or other financial mechanism that pre-funds both O&M and mitigation would help improve the efficiency and cost effectiveness of both activities, and ensure that lack of funding does not hamper achievement of mitigation goals. Funding of larger pooled mitigation areas with a single permit is more cost effective than obtaining several permits for individual sites.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low cost to implement and maintain over time.
- Potential long-term benefits to both flood management and environmental sustainability.
- Can streamline permitting process and save money to put towards mitigation activities.

Disadvantages

- May be difficult to delineate jurisdictional responsibilities and identify appropriate institution to manage the strategic pooled money account.
- Strategic pooled money account may not be sustainable without changes to maintaining agencies revenue generation.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial cost to implement.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

Could potentially decrease annual O&M costs by improving efficiency.

Potential for Cost-Sharing?

Potential for cost-sharing via federal funding or State grant funds.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

Improving O&M could contribute to a decrease in emergency response and recovery costs.

Flood Fighting Cost? (Increase, Decrease, or No Change)

Improving O&M could contribute to a decreased in flood fighting.

Effect on Damage to Critical Infrastructure?

No direct effects on public infrastructure.

Effect on Floodplain and Economic Development?

No direct effects.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

Potential to reduce State flood responsibility by improving the cost effectiveness of O&M.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

Improving funding mechanisms for mitigation could improve the cost-effectiveness of mitigation activities throughout the flood management system.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

Potential to streamline the permitting process and lower costs.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

High potential to reduce conflicts between O&M and environmental values through avoidance actions.

Social Considerations

Contribution to Public Safety?

No direct effects, but improving O&M could contribute to improving public safety.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Jurisdictional and institutional roles and responsibilities would need to be established; appropriate management and oversight for the strategic pooled money account would need to be identified; may require changes to existing laws or regulations governing funding for O&M and other flood management activities.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability

None.

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Create a strategic pooled money account that provides funds for land stewardship activities at current and future flood-related mitigation areas in perpetuity

ID MA-099

Description

Problem

Agencies maintaining some mitigation areas are unable to pay for the maintenance of the habitat that has been created in response to mitigation requirements for flood control facilities. Future projects could need alternatives for funding sources for land stewardship on the mitigation areas proposed by regulatory agencies. Mitigation is not a one-time expense and needs proper planning for ongoing maintenance of mitigation areas to be funded.

Desired Outcome

Improved funding for maintenance of flood system land stewardship activities and associated mitigation areas.

Methodology

When cost estimating is completed for a land stewardship activity, sufficient funds should be set aside for ongoing maintenance of mitigation lands. Creating a strategic pooled money account or other financial mechanism that pre-funds land stewardship activities would help improve the efficiency and cost effectiveness, and ensure that lack of funding does not hamper achievement of land stewardship goals.

Contributes Significantly to CVFPP Goal

- Improve Institutional Support

Potentially Contributes to CVFPP Goal(s)

- Improve Operations and Maintenance
- Promote Ecosystem Functions
- Improve Institutional Support

Recommendations (Retained/Not Retained)

Retained.

Advantages

- Low cost to implement and maintain over time.
- Potential long-term benefits to both flood management and environmental sustainability.

Disadvantages

- May be difficult to delineate jurisdictional responsibilities and identify appropriate institution to manage the strategic pooled money account.
- Strategic pooled money account may not be sustainable without changes to maintaining agency revenue generation.

Economic Considerations

Capital Cost? (High, Medium, Low)

Low initial cost to implement.

Annual Cost to Operate/Maintain/Repair? (Increase, Decrease, or No Change)

No direct effects.

Potential for Cost-Sharing?

Potential for cost-sharing via federal funding or State grant funds.

Emergency Response and Recovery Costs? (Increase, Decrease, or No Change)

No direct effects.

Flood Fighting Cost? (Increase, Decrease, or No Change)

No direct effects.

Effect on Damage to Critical Infrastructure?

No change.

Effect on Floodplain and Economic Development?

No change.

Effect on State Flood Responsibility? (Increase, Decrease, or No Change)

No change.

Environmental Considerations

Potential to Rehabilitate Key Physical Processes and Ecological Functions?

No change.

Potential for Adverse Environmental Impacts?

None.

Permitting Considerations?

None. The lack of a funding for land stewardship at mitigation lands has often stalled acceptance of these lands by regulatory agencies who require fully protected lands as part of the their permit conditions. Creating a strategic pooled money account could facilitate approval(s) of future mitigation lands.

Opportunity to Reduce the Adverse Environmental Impacts Associated With Operation, Ongoing Maintenance, and Repairs of Flood Management System?

None.

Social Considerations

Contribution to Public Safety?

None.

Potential to Provide Other Benefits (Water Supply, Recreation, or Open Space)?

None.

Likelihood of Implementation (Politically, Institutionally, and Culturally Acceptable)?

Jurisdictional and institutional roles and responsibilities would need to be established; appropriate management and oversight for the strategic pooled money account would need to be identified; may require changes to existing laws or regulations governing funding for land stewardship and maintaining mitigation areas.

Technical Considerations

Potential for Redirected Hydraulic Impacts?

None.

Effect on Residual Risk?

None.

Climate Change Adaptability:

None.

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